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ABSTRACT

This manual is designed to serve as a teaching aid to coaches and physical educators in the field of women's aquatics. The articles cover the following subjects in the area of water sports: (1) standards in sports for girls and women; (2) women in Olympic swimming competition; (3) conditioning programs designed to attain physical fitness through water activities; (4) the teaching of basic sailing; (5) kayaking; (6) teaching swimming to retarded individuals; (7) analysis of hydrodynamics of swimming; (8) development of swimming routines; (9) scuba diving instruction; (10) water rescue techniques; (11) teaching beginners; and (12) competitive swimming. A bibliography and a list of organizations and agencies relating to aquatics are included. (JD)

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National Association for Girls & Women in Sport

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AUGUST 1977 — AUGUST 1979

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NATIONAL ASSOCIATION FOR GIRLS
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Join the National Association for Girls & Women in Sport —

The only national association devoted exclusively to creating sport opportunities for *all* females — *all* ages, *all* levels

NATIONAL ASSOCIATION FOR GIRLS AND WOMEN IN SPORT

The National Association for Girls and Women in Sport is a nonprofit, educational organization designed to serve the needs of participants, teachers, coaches, leaders and administrators in sports programs for girls and women. It is one of seven associations of the American Alliance for Health, Physical Education, and Recreation.

PURPOSE

The purpose of the National Association for Girls and Women in Sport is to foster the development of sports programs for the enrichment of the life of the participant.

BELIEFS

The National Association for Girls and Women in Sport believes that:

Sports are an integral part of the culture in which we live.

Sports programs are a part of the total educational experience of the participant when conducted in educational institutions.

Opportunities for instruction and participation in sports appropriate to her skill level should be included in the experience of every girl.

Sports skills and sports participation are valuable social and recreational tools which may be used to enrich the lives of women in our society.

Competition and cooperation may be demonstrated in all sports programs, although the type and intensity of the competition and cooperation will vary with the degree or level of skill of the participants.

An understanding of the relationship between competition and cooperation and the utilization of both within the accepted framework of our society is one of the desirable outcomes of sports participation.

Physical activity is important in the maintenance of the general health of the participant.

Participation in sports contributes to the development of self-confidence and to the establishment of desirable interpersonal relationships.

FUNCTIONS

The National Association for Girls and Women in Sport promotes desirable sports programs through:

1. Formulating and publicizing guiding principles and standards for the administrator, leader, official, and player.
2. Publishing and interpreting rules governing sports for girls and women.
3. Providing the means for training, evaluating, and rating officials.
4. Disseminating information on the conduct of girls and women's sports.
5. Stimulating, evaluating, and disseminating research in the field of girls and women's sports.
6. Cooperating with allied groups interested in girls and women's sports in order to formulate policies and rules that affect the conduct of women's sports.
7. Providing opportunities for the development of leadership among girls and women for the conduct of their sports programs.

STANDARDS IN SPORTS FOR GIRLS AND WOMEN

Standards in sports activities for girls and women should be based upon the following:

1. Sports activities for girls and women should be taught, coached, and officiated by qualified women whenever and wherever possible.
2. Programs should provide every girl with a wide variety of activities.
3. The results of competition should be judged in terms of *benefits to the participants* rather than by the winning of championships or the athletic or commerical advantage to schools or organizations.

Health and Safety Standards for Players

Careful supervision of the health of all players must be provided by —

1. An examination by a qualified physician
2. Written permission by a qualified physician after serious illness or injury
3. Removal of players when they are injured or overfatigued or show signs of emotional instability
4. A healthful, safe and sanitary environment for sports activity
5. Limitation of competition to a geographical area which will permit players to return at reasonable hours; provision of safe transportation.

General Policies

1. Select the members of all teams so that they play against those of approximately the same ability and maturity.
2. Arrange the schedule of games and practices so as not to place demands on the team or player which would jeopardize the educational objectives of the comprehensive sports program.
3. Discourage any girl from practicing with, or playing with, a team for more than one group while competing in that sport during the same sport season.
4. Promote social events in connection with all forms of competition.

SOURCES OF INFORMATION AND SERVICE

All requests for information about services should be addressed to: Executive Secretary, National Association for Girls and Women in Sport (NAGWS), AAHPER, 1201 - 16th Street, N.W., Washington, D.C. 20036.

PREFACE

This NAGWS *Aquatics Guide: Tips and Techniques for Teachers and Coaches*, a biennial production, represents a "first" in a new publication series by the National Association for Girls and Women in Sport. Articles covering a wide spectrum of aquatic sport are presented as timely aids to teachers and coaches.

In case you have looked for official rules, a former inclusion in the NAGWS *Aquatics Guide*, these are now found in separate publications: the NAGWS *Swimming and Diving Guide*, August 1977-1978 and the NAGWS *Synchronized Swimming Rules*, January 1978-1979.

The NAGWS continues to seek input from all interested individuals as to how it can best provide publications and other materials that will facilitate the growth of quality sport programs in America. Your comments to the *Guide* chairpersons or the national office are invited.

Our sincere appreciation is extended to Marjorie M. Harris, Chairperson, for her diligence and thoroughness in preparation of this first edition.

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*The current *Guide* was prepared by the 1975-1977 Committee. The 1979-1981 *Guide* will be prepared by the 1977-1979 Committee.

OLYMPIC NAIADS

PAULA WELCH

Paula Welch received the B.S. degree from Florida State University, Tallahassee, the M.A. degree from George Peabody College for Teachers, Nashville, Tennessee, and the Ed.D. from the University of North Carolina at Greensboro. She has done extensive research relating to the history of the American woman in sport and currently is teaching at the University of Florida in the Professional Physical Education Department, College of Physical Education, Health, and Recreation.

Since their debut in the Antwerp Olympic Games of 1920, America's naiads have amassed 47 gold medals, 31 silver medals and 31 bronze medals. Included in this impressive array of Olympic laurels are 10 instances in which Americans have finished 1-2-3 in the same event.

Swimming first appeared as an Olympic sport for women in 1912.(1) The Games of 1916 were not held because of World War I. America's later entry into Olympic swimming was largely because of James E. Sullivan's opposition to women's participation in sport. The influential Sullivan was president of the Amateur Athletic Union (AAU) and secretary of the American Olympic Committee (AOC). Women's swimming came under AAU jurisdiction in November 1914 after Sullivan's death in August 1914.(5) Without Sullivan's objections women began to emerge as serious swimming competitors through AAU support. In 1917, the Women's Swimming Association of New York City (WSA) was organized and provided additional competitive opportunities for distaff swimmers. Most of the 1920 Olympic swimmers were trained by the WSA.(9)

The 1920 Olympians won all swimming events open to women which included the first three places in both the 100- and 300-meter freestyle races and the championship in the 400-meter relay. The United States first Olympic swimming gold medalist was Ethelda Bleibtrey. Bleibtrey placed first in both individual events and anchored the 400-meter relay team.(15)

The United States dominated the swimming competition at the Paris Games of 1924. The second Olympic swimming team won five out of six events. Americans finished 1-2-3 in both the 100-meter freestyle and the 400-meter freestyle events. Gertrude Ederle led the U.S. women by acquiring a gold medal in the 400-meter relay and bronze medals in the 100- and 400-meter freestyle events.(2)

America's third Olympic aquatic entry claimed three out of five titles at the Amsterdam Olympics in 1928. The United States 100-meter freestyle, 400-meter freestyle, and 400-meter relay entries collected gold medals. Silver and bronze medals were won in the 100- and 400-meter freestyle events. Americans did not qualify for medals in the 100-meter backstroke or the 200-meter breaststroke.

Martha Norelius was the first American woman to win gold medals in two different Olympiads. In 1924, Norelius won the 400-meter freestyle event. In 1928, she repeated that feat in addition to winning three out of four individual swimming events and the 400-meter relay title.(3)

Not a single gold medal was won by American women in the swimming events at the 1936 Berlin Olympics. Furthermore, the United States finished third in the 400-meter relay, the first loss since entering the event in the 1920 Games. Only two other swimming medals were claimed by Americans for third place performances in the 100-meter backstroke and the 400-meter freestyle.(7)

The United States might have won the backstroke title in Berlin had it not been for the dismissal of champion backstroker Eleanor Holm Jarrett. Jarrett was dismissed from the team because of drinking on board the ship during the trip to Berlin. The controversial Jarrett maintained that training rules were never clearly established and she was not guilty of breaking training rules.(17) Jarrett's dismissal marks the first instance in which an American woman was expelled from an Olympic team.

War caused cancellation of the 1940 and 1944 Olympics. The Olympic Games were resumed in 1948. Ann Curtis emerged as a leader in the post-war London Olympics. Curtis placed first in the 400-meter relay team and acquired a silver medal in the 100-meter freestyle event. With a silver medal in the 100-meter backstroke Americans claimed one medal in all events except for the 200-meter breaststroke.(8)

Evelyn Kawamoto, third place finisher in the 400-meter freestyle, was the only American who won an individual medal in the 1952 Helsinki Games. Kawamoto was also a member of the third place 400-meter relay team. American naiads failed to finish in any of the top three places in the 100-meter freestyle or the 200-meter breaststroke.(16)

Leading swimming medalist of the 1960 Rome Games was Christine Von Saltza. Von Saltza anchored both the gold medal 400-meter medley relay and the 400-meter freestyle teams. She acquired another gold medal in the 400-meter freestyle and a silver medal in the 100-meter freestyle race.(12) Two additional titles were claimed by Americans in the 100-meter breaststroke and the 100-meter butterfly. The breaststroke was the only event in which Americans failed to finish among the top three places.(11)

In Tokyo, the 1964 U.S. Olympians swept the 400-meter freestyle and the 400-meter individual medley. They dominated both relay events. Americans placed first and third in the 100-meter backstroke and the 100-meter butterfly. Other accomplishments included a second and third finish in the 100-meter freestyle and for the first time a medal in the 200-meter breaststroke. Claudia Kolb won a silver medal in the breaststroke race.(10) Sharon Strouder's three gold medals in the 400-meter freestyle, medley relays and the 100-meter butterfly as well as her silver medal in the 100-meter freestyle event was an unprecedented achievement.(4)

For the first time in the history of the Olympic Games the athletes were summoned to compete in a Latin American city. At Mexico City, in 1968, America's swimmers led by Deborah Meyer collected 12 gold medals, 7 silver medals, and 8 bronze medals. Meyer set Olympic records in the 200-, 400- and 800-meter freestyle events. When the Games had ended the United States possessed an unbelievable 12 out of 14 Olympic championships.(6)

In Munich, the 1972 U.S. Olympians won half of the 14 swimming events. Melissa Belote led the Americans by acquiring two gold medals in the 100- and 200-meter backstroke races and a gold medal for swimming a leg of the 400-meter medley relay. For the fourth consecutive Olympiad American girls won both the 400-meter freestyle and the 400-meter medley relay.(13)

The United States' only gold medal performance in the 1976 Montreal Olympics occurred in the 400-meter freestyle relay. The 400-meter medley relay team finished in second place. Shirley Babashoff was the most successful American naiad at the Montreal Games. Babashoff was a member of the championship 400-meter freestyle relay team and won silver medals in the 200-, 400- and 800-meter freestyle events. Two bronze medals were won by Americans in the 800-meter freestyle and the 100-meter butterfly competition.(14)

AAU control and organization during the formative years of women's Olympic swimming provided a foundation for continued development of the sport in America.

Virtually all women who have entered Olympic swimming competition received training through AAU affiliated swimming clubs. Absence of educational institutions from Olympic preparation until recently reflects the conservative attitude toward competition expressed by most women physical educators. The Association for Intercollegiate Athletics for Women is providing more opportunities for highly skilled women to pursue challenging competition and will no doubt contribute to the development of Olympic swimmers in the United States.

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SWIMNASTICS*

MG SHOLTIS

MG Sholtis received the B.ed. degree from the University of Miami, Coral Gables, Florida, and the M.S. and Sixth Year Professional Diploma from Southern Connecticut State College in New Haven, Connecticut. She is the recipient of the 1976 Mable Lee Award from AAHPER, the 1975 EDA Outstanding Teacher Award and the 1975 CAHPER Professional Service Award. Author of two handbooks: Swimnastics Is Fun *and* Slimnastics Is Fun. *MG Sholtis is an assistant professor of recreation and leisure education at Southern Connecticut State College.*

Swimnastics is the study of various conditioning programs designed to attain and maintain physical fitness through water activities. Swimnastics is designed to encourage one to become involved in recreational water activities, so that he or she may reap better personal fitness rewards while having fun! Using sound teaching principles, swimnastics can be enjoyed with benefit by young and old, healthy and infirm, and swimmers and nonswimmers.

There is a demand for qualified personnel to instigate, organize, administer and evaluate swimnastics programs each year. Every health, physical education and recreation curriculum should give students an opportunity to study the various innovative and creative techniques and methods employed in such programs. Swimnastics can easily be incorporated into existing swimming instructional programs at any level. They can also be altered to meet the needs of special populations.

Origin and Development

The dictionary defines recreation as "refreshment after toil" or the "act of creating anew." Swimnastics is an outgrowth of physical therapy and hydrotherapy which offer temporary relief from discomfort and pain. During the past several years, health experts have come to realize that exercises and activities created especially for swimming areas can satiate a need for relief while toning the muscles, strengthening the heart, improving circulation and pacifying the spirit of people of all ages and conditions. For these reasons, swimnastics is not only popular with municipal and private recreational agency clientele, but also very helpful for elderly participants and other special population groups.

Because of its great scope of possibilities, swimnastics has a strong appeal for the college student and general public. From an educational point of view, it affords an opportunity for creating experiences in an aquatic environment while facilitating the mastery of fundamental swimming skills.

Terminology

Ditty Bag — a small household plastic bag

Mainstreaming — incorporation of members of special populations into regular swimnastics activities

Special Event — an activity designed for water carnivals and/or water demonstrations

Special Populations — those individuals who have learning difficulties and/or certain incapacitating conditions

*This article is taken from MG Sholtis' book, *Swimnastics Is Fun* (AAHPER, 1975).

Swimnastics — the study of various conditioning programs designed to attain and maintain physical fitness through water activities while the body is submerged in water

Safety First

Before choosing swimnastic activity, sound teaching principles require that caution be exercised in the evaluation of games, contests, stunts, relays, and/or conditioning programs in terms of their suitability and benefit to the participants. Some factors that influence the suitability of recreational water activities are:

1. Comfort of the participants — temperature of both air and water
2. Age
3. Ability
4. Sex
5. Number of participants
6. Time allotment
7. Water space
8. Equipment availability
9. Swimmers' interests and preferences
10. Relationship to instructor
11. Danger
12. Benefits
13. Practicality
14. Social benefits

Once the instructor has taken care of all the safety practices, he or she can concentrate on the beneficial recreational water activity.

Types of Swimnastics

Any fun-filled activity that can be adapted to an aquatic environment has the potential to become a swimnastics idea:

1. Water exercises — various combinations of calesthenics, circuit training patterns, exercises to music, aquacises, aquathenics, and even belly dancing to encourage individual figure control
2. Relays and races — designed to increase stamina and endurance on an individual and team competition basis
3. Novelty games — individual, partner, group, novice, beginner, intermediate, swimmer and lifesaving activities to facilitate the mastery of skill on all levels
4. Sports — water-related and adapted games such as water polo, basketball, volleyball, field hockey, etc.
5. Drills — various exercise drills and repetition in circle, diagonal and line variations
6. Conditioning programs — those programs especially designed to meet the needs of competitive teams, senior citizens, handicapped, etc.
7. Special events — culminating activities for programming such as water carnivals, synchronized swimming routines, skill testing and combatives.
8. Special population activities — those activities designed to meet the needs of adaptives, handicapped, disabled, blind, geriatrics, etc.

Equipment and Supplies

A swimnastics program is relatively inexpensive. Students will enjoy a scavenger hunt to locate items that will bring them many hours of fun in the water. Occasionally,

the instructor may contribute an extra item or two, but the "ditty bag" provided by the participant should contain the following goodies:

1 small bag of balloons	1 plastic spoon
2 ping pong balls	6 band aids
5 pennies	1 small stone
1 sheet newspaper	matches
1 pair 40" shoelaces	birthday candles
2 plastic corks	1 whistle
1 rubber ball (hand size)	2 plastic straws

Teaching Hints at Skill Levels

The swimnastics instructor should be ever mindful of the influencing factors which govern the suitability and benefits of recreational water activities. The instructor should:

1. Emphasize activities which keep the *entire group* active
2. Make the membership of teams equal in number *and* ability to preserve the challenge of a competitive situation
3. Exercise judicious control over the participants
4. Be enthusiastic *without* dominating the group. The instructor's personality will help make the game fun.
5. Explain each game, stunt or relay completely and clearly. Ask for questions.
   a. Rules should be simple and safe.
   b. Rules should be changed if they do not fit the situation or the facilities.
   c. A winner always should be announced.

At the learn-to-swim level, especially with children, swimming should be an enjoyable activity. Where possible, everything should be a game or stunt. The instructor should find out the ability and interest of the group and give the students games and stunts they enjoy which reinforce skills and basic water adjustment.

At the junior level, a sense of accomplishment can be obtained by using skills and strokes already learned; repetition will encourage mastery. Relays and games with the element of competition should be used to alleviate boredom and monotony. Endurance and stamina can be increased at this level.

At the end of the activity, the instructor should line up members of the group and quiet them down. A winner should be declared in a competitive situation, and a brief explanation given on why the activity was included in the class session. Always dismiss a class under control — good safety practice!

"Mainstreaming" through Swimnastics Activities

Swimnastics offers an opportunity to incorporate members of special population groups into regular swimming classes and/or activities. There are innumerable adaptations that instructors can make to game rules and equipment, so that disabled individuals can participate actively and constructively. It is vitally important that individuals be given the opportunity to share in the joy of discovery while having personal needs for movement met. Remember, water activities are for the benefit of all!

The values of a recreational swimming program for the retarded and physically handicapped are limitless. Persons who have learning difficulties and certain handicapping conditions are exposed to an improved learning environment, namely — the water. A handicapped person benefits from water-learning swimming lesson programs at any level of instruction. They can be altered to meet the needs of special

populations. A swimnastics program is innovative and creative: It can be a valuable adjunct to fitness programs in schools and colleges, recreation departments, retirement facilities, camps and youth-serving facilities such as YMCAs and YWCAs. The benefits, especially to the elderly and handicapped, are immeasurable. Most important, swimnastics programs offer everyone an opportunity to enjoy recreational water activities while reaping better personal fitness rewards and having *fun*!

SWIMNASTICS IS FUN!

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TEACHING BASIC SAILING

BONNIE WIENCKE

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Sailing is learned primarily on the water, not in the classroom. The teacher must be able to balance theory and practice to help the student grasp the concepts and skills involved. Too many facts often hinder learning while not enough information can prove frustrating. In a sport as complex as sailing, it is a challenge to simplify experiences in an effort to facilitate success for the beginner.

The purpose of this article is to share some insights and make some suggestions for teaching beginning sailors. The situation to which most of these suggestions relate is group instruction in dingies where one or two students sail in each boat. However, the ideas are also applicable to teaching either a private lesson or a small group in a trainer boat.

The task of rigging can be overwhelming to the beginner. Start by presenting the bare necessities to get the boat properly rigged and unrigged. Teach only the knots and terminology necessary to accomplish the task. Briefly discuss the essential tools: tiller, rudder, centerboard and sails. Do a quick demonstration on rigging and then let the class rig its own boats. With a fair amount of time, a few words of assistance and some patience, the boats can be completely rigged and unrigged successfully.

The first day out, sailing is exciting but it should be well thought out so that the students have a positive experience and fears are minimized. Remember to simplify the experience and concentrate on a few specific tasks. Three important considerations to stress the first time out are positioning in the boat, steering and changing tacks by coming about. Specifying positioning in the boat is important because beginners will have a constant reference if they always sit to windward, forward of the end of the tiller if possible, and facing the sail. Steering is less confusing if the skipper has a specific point or landmark toward which to head. Trial and error then teaches the skipper how the tiller works.

Changing tacks by coming about, rather than by jibing, allows the beginner more time to change position and reorganize. Since wind direction is usually confusing to the beginner, it is also necessary to specify the direction the boat should turn when coming about. Emphasize that the skipper faces forward when changing sides and watching how far the boat is turning. Again, it is best to have an object toward which to head after tacking. To simplify the procedure of tacking, avoid use of the hiking stick if possible. With regard to sail trim, the class needs only to be told to pull the sail in if it luffs and to let it out if the boat is heeling too far.

A good initial exercise is to reach toward a marker or landmark, come about and reach back toward the dock or another marker. Do not require that the markers be rounded because that is too difficult for beginners. This experience should give the sailors some feel for steering, an awareness of where to position themselves in the boat and some idea of the meaning of changing tacks.

Within the first few lessons, each sailor should experience capsizing in a controlled situation. If the boats are not self-rescuing or if the water is excessively cold, this exercise becomes difficult if not impossible. Many fears can be avoided if each sailor is confident of being able to handle a capsize. When using self-rescuing boats, beware of youngsters who are too light to right the boat or individuals who have trouble getting back into the boat.

The terms, "heading up" and "bearing off," are often used when directing beginners on the water but the actual concept involved is surprisingly difficult for beginners to grasp. This may be because beginners have trouble keeping track of wind direction. Discussion of the terms and specific experiences on the water serve to check the skipper's understanding. Many beginners have to remember which way the tiller goes — toward the sail or away from the sail — rather than being aware of the boat turning toward the wind or away from the wind. This latter perception usually takes time to recognize directly.

Once beginners have been in a boat, they are better able to relate to explanations of what is happening while under sail. The basic theories of sailing can be introduced. Students are generally interested in the dynamics of the sail and the centerboard. Such information helps them to understand the importance of sailing "just-off-a-luff" and why sailing downwind is slow. The familiar sailing compass is useful for diagramming the relationships of the wind, the sail and the boat. However it is important to remember that although the sailing compass is very simple and all inclusive to the experienced sailor, it is not so easily understood by the beginner. When initially discussing theory and describing the compass, avoid using the terms beat, reach and run. Concentrate on sail trim in relation to changes in heading and on changing tacks by coming about and jibing.

It is imperative for the sailing experiences to be composed of relatively easy tasks so that the students can begin to understand the theory in practice. By continuing to give specific tasks, the instructor can judge to some degree how well the students are progressing. The tasks can gradually become more difficult by changing the angle of the reach until the course is windward-leeward. Devising obstacle courses also adds variety. Remember that wind velocity greatly affects the difficulty of a given exercise.

While doing a modified reaching course on a light wind day, jibing practice can be introduced. The sailor would jibe at the more leeward marker and perhaps go around the more windward mark. Landings also require some special attention. One or two boats at a time can be practicing landings while the others are working on the modified reaching course. If a dock is not near the instructional area, a moored boat will do fine for practicing landings.

At some point, particularly if teaching on a small lake where the wind is very shifty, it is necessary to teach how to get out of irons. Most beginning sailors can relate very well to this experience. The effect of a backwinded jib also needs to be explained so that those mysterious come abouts are finally understood.

Sailing efficiently upwind is the most difficult aspect of sailing for most beginners. The approach suggested here is one of slowly working up to sailing upwind. The most common faults when beating are not pulling in the sails, not using fine and quick enough adjustments with the tiller, and not concentrating on the jib luff. Sailing upwind requires a feeling for working the boat, for sensing how high to point while maintaining speed. This takes experience.

Teaching sailing is most rewarding when the students experience success and accomplishment. They are no longer beginners once they can sail a triangular course alone.

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A CASE FOR KAYAKING

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Each year more people are spending money, time and effort for recreational pursuits on our outdoor aquatic resources, and all too many have pursued an untimely death. Statistics provided by the American Canoe Association show several revealing facts concerning river-running fatalities. For instance, a higher fatality rate occurs during the spring months when rivers are usually higher and swifter, the weather and water are colder and participants likely to be less prepared. In 1973, 68 percent of the canoe-related accidents or fatalities were attributed to cold water and weather, 53 percent were caused by inadequate skills and 37 percent were caused by inadequate or no flotation. Further statistics reveal 58 percent of the fatalities occurring between the ages of 12 and 24 and 94 percent involving males.[1] Because statistics seem to show an increase in young people engaging in a potentially dangerous sport without adequate knowledge, it seems necessary to evaluate the statistics in relation to the motivations and knowledge of the whitewater paddler, and also to evaluate the programs offered to these individuals.

Some whitewater participants are "danger-seekers," possessing what has been labeled recently "the Deliverance Syndrome." Others, however, are seeking a true evaluation of their physical and mental capabilities, escaping from stressful situations in tune with an overpopulated world, and attempting to coexist with and appreciate the beauty of their natural environment. For whatever reasons, the number of whitewater participants is increasing, and along with this comes an increase in ease of obtaining whitewater equipment. Although there is a definite concern in all areas of whitewater boating, it becomes intensified in the emerging whitewater sport of kayaking. This specific concern stems from the lack of instructional guidelines and programs such as those included in high schools, colleges and clubs; the lack of widespread knowledge concerning safety equipment and techniques; and the potentially vulnerable situations the novice kayaker may encounter.

If, in fact, river-running fatalities seem to be more prevalent among high school and college-age individuals, and if at this age we find an abundance of adventurous individuals, it would seem logical and perhaps ideal to direct the kayaking instructional programs toward these age groups. However, upon inspection one finds a definite lack in the number of educational kayaking programs offered at either the high school or college levels. It is hoped that those interested in kayaking will understand that this type of program is more feasible than realized and will pursue the development of courses in their institutions.

Water

It is obvious that water is one imperative requirement for a program in kayaking. Ideally, the program that has access to an indoor pool, a pond or lake and a river with areas of excessive pooling to areas of challenging whitewater, can accommodate all

[1] David G. Cowart, "Course Safety Programs: A Presentation to the National Water Safety Congress," Milwaukee, WI April 17, 1975, pp. 12-18.

levels of skill progression. For the beginner, the pool eliminates such problems as cold water, currents, excessive wind and submerged objects, and provides clear, warm water for rolling progressions. The pond, providing a less confined area for practicing acquired flatwater skills and introducing natural obstructions to the novice, serves as a gradual progression from pool to river sessions. Rivers should ideally have a variety of offerings. Poolings generally appear at most water levels and are useful for rolling practice, for grouping and recuperating below a rapid and for practicing necessary rescue techniques. The fast water sections should include riffles and short rapids with adequate pools below. These areas can be utilized by all skill levels, particularly the novice, a boater with flatwater and beginning whitewater skills. Beyond these stipulations, the character of the river can change to challenge even the advanced students seeking more difficult runs comprised of rock gardens, haystacks, reversals and stoppers.

One should not become anxious when visualizing limited facilities compared to the above ideal description. Often pooling areas of a river must substitute for a pond or even a swimming pool, or one may need to conduct an entire introductory course in a pool situation. Other programs which must be restricted to school facilities during the week can incorporate weekend trips to neighboring rivers or lakes. With adequate transportation and experienced shuttlers, one can handle many students during a weekend, and often this period becomes ideal for incorporating interdisciplinary field experiences in such areas as history, biology, geology and outdoor teacher education. If one remembers not to dwell on the limitations of a program, even the most modest of facilities can be used efficiently to produce a highly successful program.

Equipment

In addition to water, equipment becomes a necessity. An introductory program may start with a modest fleet, a few paddles and an adequate number of float bags. However, as soon as the course progresses to open water the equipment area must also expand. Personal flotation devices, helmets and rescue equipment become mandatory. Beyond this, spray skirts, storage bags and wet suits can serve to extend the program to more exciting water, longer trips and cooler weather and water situations. Equipment can be purchased ready-made from various retailers throughout the country. If one is inclined to take the less expensive route, there are kits available, and of course, for the extremely ambitious, most equipment can be constructed if raw materials, molds, expertise in working with resins and lots of patience are available. This method of obtaining equipment can cut expenses in half, an attractive statement to most budget committees.

Instructor

The third basic necessity is a knowledgeable instructor, most critical to the success and safety of the program. The instructor not only should have command of the basic skills and advanced rescue techniques, but also should have great strength in judgment through whitewater experience. Many times this experience will determine the safety of all students involved. In addition, there is a need for knowledge in the area of equipment, first aid and preventive safety. With careful trip preparation, an instructor can use all of this knowledge to prevent use of inadequate equipment and supplies and damage to or loss of equipment. More important, loss of life and injury can be prevented by avoiding situations which require skills beyond those of the student.

There are several methods by which an instructor can acquire the skills and knowledge to lead a program. One can seek out an instructional program or series of

workshops, join an established club and follow the examples of knowledgeable participants, enlist the services of a kayaker to teach a course in which the potential instructor participates, or enlist the services of such an individual to extend the course beyond the limitations of the instructor. No matter what method is pursued, the instructor will certainly feel a great sense of accomplishment in eventually obtaining personal skills and passing this knowledge on to eager students. Certainly after the instructor develops enough precision and judgment to be fully engrossed in the turbulence, he or she can help the student discover the amplified thrill in "working a river" rather than simply "running it." One cannot help but feel a thrill in outwitting the monstrous haystacks and holes, and yet each should know the respect due the unyielding torrents during intense seconds of misjudgment. Using such experiences in teaching can help facilitate self-realization and enrich the educational experiences of our students.

TEACHING SWIMMING TO SEVERELY OR PROFOUNDLY RETARDED INDIVIDUALS

JAMES J. AGLI

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When a course for instructors to teach swimming to the handicapped was included in a specialized Master's degree program dealing with physical education for the handicapped, the instructor trainer felt that the course should offer and emphasize a practical experience. In planning for the program, arrangements were made to offer swimming to two groups of severely and profoundly retarded children and young adults from two nearby regional centers for the retarded. As a result of the course and the experience of working with the severely and profoundly retarded, this article is presented offering guidelines and suggestions. There is no intent to indicate that these are the answers or only methods for efficiently and effectively teaching the severely or profoundly retarded individual to swim or enjoy the water. It is hoped that the program will be maintained to allow a continuous evaluation of approaches and methods of teaching.

Descriptions of Severely and Profoundly Retarded Individuals

Severely retarded individuals are basically totally dependent on others. Although they may have a small vocabulary and limited abilities in self-care, they need to be cared for and protected. Because the individuals' physical abilities and perceptual abilities are extremely limited, instruction is difficult, thus, it is important to have an instructor-student ratio of one-to-one.

The profoundly retarded are similar, although categorically lower functioning, with a lower IQ and considerably less speech and self-care abilities. In addition to having impairments in speech, language and motor development-physical coordination, the profoundly retarded may also suffer from other impairments such as blindness, deafness or cerebral palsy.

Values of a Swimming Program

To the severely or profoundly retarded individual, whose existence so often consists of habitual daily rituals, the values derived from experiencing the freedom of the water are immeasurable. One important aspect in the development of any human being, whether retarded or not, is stimulation, and a swimming program offers the stimulation of new feelings, sights and sounds.

Another value derived from a swimming program is physical development — the strengthening of muscles through exercise, the stretching out of constantly contracted muscles, and muscular coordination. Using this medium for such a goal is of exceptional importance, for movements become easier when performed in the water. A severely or profoundly retarded individual, whose muscles often are poorly

developed through lack of use, may gain a greater range of movements and utilize more muscle groups while in the water.

Still another value is socialization. This is not to say that one individual might get acquainted with another or learn group behavior; the severely or profoundly retarded individual cannot function at that level. However, by being in a group, hearing each other, seeing and touching each other, these individuals may get a sense of being with people, which is important not only to the basic human self, but also aids in the individual's overall development.

One final value derived from a diversified swimming program is that of a sense of achievement. The severely and profoundly retarded *do* realize achievement. Although the achieved goal itself may be minute, the sense of accomplishment, to them, is not, and it may then carry over to other areas and aid in their overall development.

Objectives of the Program

When evaluating a program for the severely or profoundly retarded, an important key is whether the specific objectives as well as the overall objectives of the program were satisfied. The objectives are not solely that the individual ends up a safe swimmer (although this may be a product of the instruction), but also that the person has the values which may be derived from a swimming program. If the individual has experienced new stimulation, achieved greater physical development, been exposed to a social atmosphere and tasted achievement, then the objectives have been met and perhaps the individual may have learned to swim in the process. The swimming program for the severely or profoundly retarded must be *centered around the individual*.

Skills To Be Taught

Teaching of skills to the severely and profoundly retarded is very limited and very slow. Skills must be simple and the entire swimming program must be very elementary.

Perhaps the most important part of the swimming instruction is presenting the proper skills and providing sufficient practice so that a pattern of movement can be developed. In this program, the most prevalent swimming stroke was found to be a head-up freestyle using a bicycle kick with alternating arm movements under water. Blowing bubbles, breath holding, putting the head under water, and floating on the front and back are fundamental requirements in becoming adjusted to the water. Just as important, however, are the means of propulsion, which involve kicking on the front and back and an arm stroke on both the front and back. Once each skill is practiced, the next step is that of combination and coordination. The instructor should not expect a great deal, especially in the performance of a skillful stroke. Gaining even slight proficiency, in any skill, may be an extremely long and tiring process. The swimming instructor will need to be well versed in a variety of swimming skill progressions with emphasis on beginner skills. The skills taught depend on the capabilities of the individual.

Methods and Approaches

Some methods proposed for the teaching of skills to the mentally retarded are the spiral concept,[1] the multisensory approach, the game approach, and the Modified

[1] Walter, Ersing, "The Spiral Concept — An Approach In Teaching Swimming To The Developmentally Disabled And Mentally Retarded," *The Physical Educator* 31, no. 2; May 1975, 72-74.

Gabrielsen's Total Push-Kick Method.[2] Limited experimentation with the Gabrielsen Method was utilized, and it suited the needs of these individuals. It was learned by experience that the individuals usually had to be persuaded, sometimes forcibly, to perform and practice certain skills.

In the implementation of the chosen method there are many teaching suggestions. Try to maintain a one-to-one teacher-pupil ratio. Before even attempting a class or lesson, the instructor must know as much about the individual as possible because it will affect the entire teaching structure. A method of communication needs to be established in many cases. The instructor may need to develop some knowledge of signaling or gesturing before the first swimming session. A case history, which is necessary for safety as well as technique, provides information on those who are prone to seizures or other exceptional behavioral traits. These students should wear identifying bathing suits or caps to distinguish them from the others.

The teacher's attitude is of utmost importance in a program of this nature. Patience and understanding are vital. Caring for a person with severe retardation requires tact, compassion and imagination in arranging a swimming program. Constantly speak to the individual, use his/her name often, and maintain eye contact. Smile and laugh. Seek facial expressions and responses. One of the most important things to remember is never underestimate the retarded individual.

Care must be taken not to strain tightly contracted muscles. Try to achieve large motion of the limbs with clapping, splashing and kicking. Locomotion is emphasized, not exact mechanics. Do not wait for proficiency in one particular skill before moving to another, for it may never arrive.

Flotation devices enable the individual to gain more freedom and independence in the water and leave the instructor free to manipulate and pattern the desired movements. The type of flotation device used depends upon the individual. Using the belt-type flotation device enables part of the belt to be eliminated as the individual gains experience skill.

In conclusion, when preparing a swimming program for severely or profoundly retarded individuals there are a vast number of variables which must be considered. Some which have not been discussed are transportation, shower and dressing facilities, medication and staff.

[2] E. L. Bundschuh et al. "Teaching the Retarded to Swim," *Mental Retardation* 10, no. 3: June 1972, 14-17.

A HYDRODYNAMIC APPROACH TO SWIMMING ANALYSIS

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When evaluating swimming form, teachers or coaches frequently judge the stroke on the basis of how closely it resembles a model performance exhibited by a successful competitor. Unfortunately, however, the techniques of champions often are copied without consideration for the relative merits of the mechanical details of the performance. Consequently, the ineffective as well as the effective characteristics are imitated. A review of popular swimming literature usually provides the reader with descriptions of swimming movements which are stated in general terms and offer little explanation of why such movements are proper or effective. Similarly, faults in technique are identified with no clear rationale as to why they detract from the performance. As more teachers and coaches are becoming familiar with the hydrodynamic principles basic to understanding swimming technique, more accurate information is being given to the learner and competitor to expedite skill development.

Research in swimming continues to provide answers to common practical questions, although the dissemination of this information from researcher to teacher has been limited. It is hoped that the following discussion, based on fluid mechanics and research findings, will serve to clarify the factors affecting a swimmer's performance. With the recognition and understanding of the nature of the forces acting on the swimmer's body and body segments, the teacher and coach will be in a better position to analyze any given stroke technique and to prescribe modifications necessary for improvement.

Forces Acting Against the Swimmer

Total body drag is the force which resists the body's forward motion through the water. It is the sum of three different sources of resistance — surface drag, wave drag and profile drag.

Surface drag, or skin friction, is a retarding force caused by the water flowing backward along those surfaces of the body which move forward through the water. Compared to the other types of drag it is probably of least significance. The smoother the skin and swimming suit and the smaller the surface area of the body, the smaller this source of resistance. The use of oils, lotions or other coatings applied to the body have not been shown to increase skin friction.

A second source of resistance is wave drag, caused by the formation of waves at the water's surface in front of the moving swimmer. As the speed of the swimmer increases, the size of these bow waves increases and the "wall" of water presses backward against the swimmer, just as the wave against a bridge piling exerts more

force as the speed of flow increases in a river. Bow waves will be formed against the leading surface of any parts of the body moving through the air-water interface, as illustrated in Figure 1. The formation of bow waves also will increase with up and down movements of the body as well as with swimming speed. When the swimmer is completely submerged, wave drag is eliminated.

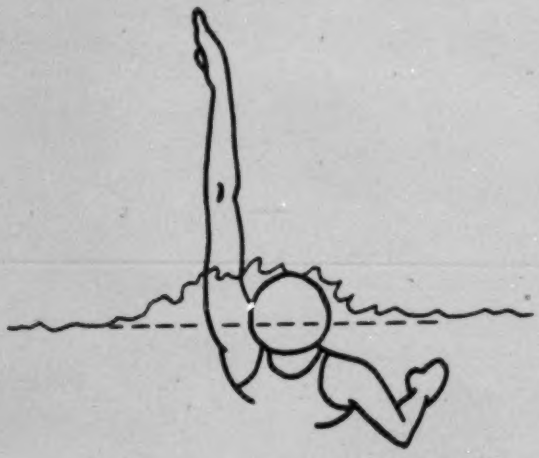
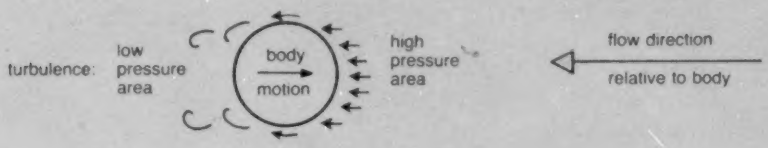


Figure 1. Wave drag against the head and recovering arm traveling forward through the surface of the water.

The most significant form of resistance in swimming is profile drag, often referred to as form drag or viscous pressure drag. The amount of profile drag depends on the size, shape and speed of the swimmer. As the body moves forward through still water, the water flows backward relative to the body. The water is spread apart to allow the body to pass through it. The greater the frontal area of the body and body parts which move forward through the water, the greater is the drag. It is called pressure drag because of the difference in pressure formed between the front and back surfaces of the part moving through the water. High pressure zones are created on the leading surfaces of the body, and low pressure zones are formed at the downstream sides where the water is turbulent, thus creating a suction effect (Figure 2a). The result is a net force backward against the swimmer. As the speed of the body increases (thereby increasing the speed of water flow relative to the body), the pressure differential increases and the resistance becomes dramatically larger. As the frontal area of the body facing the flow is decreased, as when the body is maintained in a horizontal position rather than one in which the legs are lower than the upper body, the profile drag can be effectively reduced.

If the body shape is streamlined, that is, if the body tapers gradually from shoulders to hips to feet, the profile drag will be less than it would be for a body with irregular contours. Contours in the body cause water to flow at varying speeds around these shapes, and turbulence is created on the downstream side, thus producing low pressure, or suction, zones. The streamlined shape is largely predetermined by the swimmer's body build, whereas the frontal area facing the flow is a factor which can be varied by changing the body position and how the body parts move forward

through the water during recovery, or preparatory, movements. Figure 2b shows how profile drag affects a breast-stroker during the recovery phase.



a) Profile drag caused by pressure differential due to turbulence

b) Profile drag on swimmer during breast stroke recovery

Figure 2. Profile drag on a swimmer moving through still water. The motion of the swimmer creates the flow of water relative to the body.

The total body drag represents the resistive force which must be matched by the propulsive forces if the swimmer is to maintain a constant speed. If the swimmer is to increase speed, the propulsive forces must be greater than the total body drag. If the drag is greater than the propulsive forces, the body will decelerate. Speed fluctuations are quite apparent in the side stroke, elementary backstroke, and breaststroke because of the intermittent propulsive movements of the limbs and the high drag of the underwater recovery movements. To keep the resistive drag on the limbs to a minimum, the speed of the underwater recovery movements should be relatively slow, and the surface area of the limbs facing the flow should be minimized. To take full advantage of the propulsive movements, the rest of the body should be in as streamlined a position as possible for minimum drag. Less apparent, but still present, are speed fluctuations in the butterfly stroke. The over-water arm recovery eliminates the drag caused by the underwater recovery in the conventional breaststroke, and the wave-like leg movements in the dolphin kick provide more or less continuous propulsion. A more constant body speed is observed in the front and back crawl strokes because the limbs operate to provide some propulsive force throughout the total stroke cycle.

Forces Acting To Move the Swimmer Forward

The traditional concept of using the hands as paddles to move the body forward is being questioned by an increasing number of investigators as an efficient technique in swimming. The popularity of this viewpoint undoubtedly stems from the perception of what the arms seem to be doing in a stroke as well as from what the arms appear to be doing from the point of view of the observer. As a result of these visual and

kinesthetic impressions, most descriptions of swimming strokes depict the movements of the hands and arms in relation to the swimmer's body. This approach is useful for communicating how movements should be executed by the performer, but it also blinds the analyzer to how the hands are moving in relation to the still water surrounding them. Indeed, it is this interaction between the limbs and the resistive medium which is responsible for the forces which make propulsion possible. An understanding of the two types of force which can be produced by the hand moving through water is necessary to properly evaluate a swimming performance. The two types are those of drag force and lift force.

Drag Force on the Hand

Drag force on the hand is that which is produced during a paddling or pushing movement. The drag force acts against the hand movement through the water, just as body drag acts to resist the forward progress of the swimmer. Figure 3 shows how a drag force is produced on the hand if it moves through the water so that the flow is directed against the palm. A high pressure zone is created on the palm, and a low pressure zone is created on the back side of the hand. In order for any drag force to exist, there must be hand movement through the water, that is, there must be water flowing relative to the hand. The faster the movement and/or the larger the hand, the greater the drag force against it.

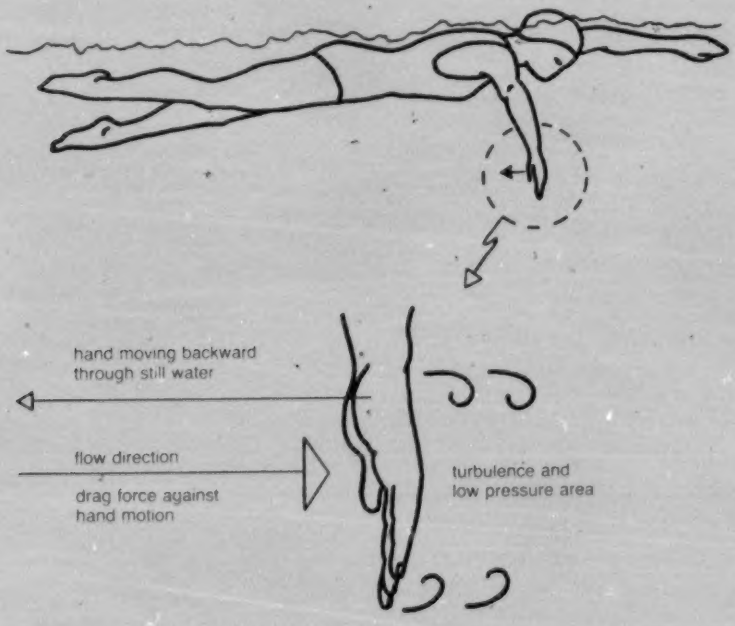


Figure 3. Drag force on hand caused by moving the hand backward through the water.

The popular notion has been that in order to move the body directly forward, the swimmer must pull or push the hands directly backward through the water. It is true that great pressure is felt on the hands when the arms are moved backward quickly

through the water; but how is this resistance used to move the body forward? Before an answer is given, consider the following: The ideal situation would be one in which the hand could grip an underwater handle which would not move backward as the hand pulled on it. With such a handle the contraction of the arm and shoulder muscles would then cause the body to be pulled forward toward and past this handle as the arm went through its range of motion. If, however, this handle were not fixed solidly within a section of water, but slipped backward as the hand pulled on it, by the time the arm had pulled through the same range of motion as before, the body would not have been moved forward through the water very far at all. Instead, the body would be moved forward a little as the hand holding the slipping handle moved backward. Since the purpose of a stroke is to move the body forward, any backward hand movement through the water results in less forward motion of the body per arm stroke.

Return now to the original question: How is the drag force against the hand used to move the body forward? The answer is, just as a slipping handle was used in the analogy described above. The drag force against the hand provides some resistance (counterforce) to be used as a handle, but it is necessarily a slipping handle because there must be hand motion backward through the water to produce any drag force at all. If a greater drag force was needed to provide a greater counterforce, the hand would have to slip even faster, thus yielding even less forward body motion by the time the arm reached the end of its stroke. The use of plastic hand paddles, however, increases the area of the hands and therefore increases the drag force against the hands without an increase in the speed of the hand motion backward through the water. Thus, when hand paddles are employed in practice, less backward hand motion and more forward body motion can occur with a paddling, or straight-back, type of arm pull. Whether or not hand paddles should be used for producing drag force in the learning process is still open to question since highly skilled swimmers have been observed *not* to use straight-back type arm movements in any stroke under normal swimming conditions.

The efficiency of using the hands as paddles to create a drag force by pushing straight back through the water is apparent. A more efficient use of the hands for propelling the body, that which is exhibited by highly skilled swimmers, is presented in the next section.

Lift Force on the Hand

Lift force on the hand is that which is produced by sculling movements, large as well as small. It is important to realize that the direction of a lift force is *not* necessarily upward, as the term "lift" implies. Lift force is felt as pressure on the palm when the slightly "tilted" hand slices or blades through the water. Just as hand motion through the water was necessary for creating a drag force on a paddling hand, hand motion is required to produce lift force on a blading hand. The flat, wing-like shape of the hand permits its use as a hydrofoil which can slice through the water at a slight angle to produce a lift force. The direction of lift force is perpendicular to the path of hand motion.

Lift force can be explained in terms of Bernoulli's principle which states that in a region of high flow velocity (water flow relative to the moving hand), a low pressure zone is created; and in a region of low flow velocity, a high pressure zone results. For example, when air flows past an airplane wing the flow velocity across the top surface is high, and a low pressure region develops there. Under the wing the flow velocity is low, and a high pressure region develops there. As a result, there is a net force on the

wing directed from the high pressure zone underneath to the low pressure zone on the top. This same type of pressure differential is created on the hand when it blades through the water with a small angle of attack between the palm and the direction of flow past the hand.

The use of lift force is demonstrated in Figure 4, which shows a swimmer treading water by using broad horizontal blading movements of the hands. Also shown is how the lift force (in this case, in an upward direction) is produced on the hand as it blades through the water so that the flow encounters the palm at a small angle of attack. The hands do not push downward toward the feet, but remain blading inward and outward in the same horizontal plane underwater. Used in this manner, the hands create what might be termed "lift force handles" or "blading handles" which provide the counterforce on the hands necessary for maintaining the head above the surface of the water. If the swimmer in Figure 4 is transposed to a prone position in the water, similar sculling movements, with the palms now facing backward, would result in lift forces on the hands directed horizontally forward. If the shoulder muscles were to contract and shorten, as if to move the hand and arm toward the feet, at the same time the hand is blading laterally with respect to the body (in the body's transverse plane), the lift force on the hand would provide a fairly stable handle, and the body would be pulled forward through the water with relatively little hand slip backward through the water. Thus, by blading the hand at right angles to the direction of body travel, the horizontal lift force on the hand provides a relatively slip-free handle (counterforce),

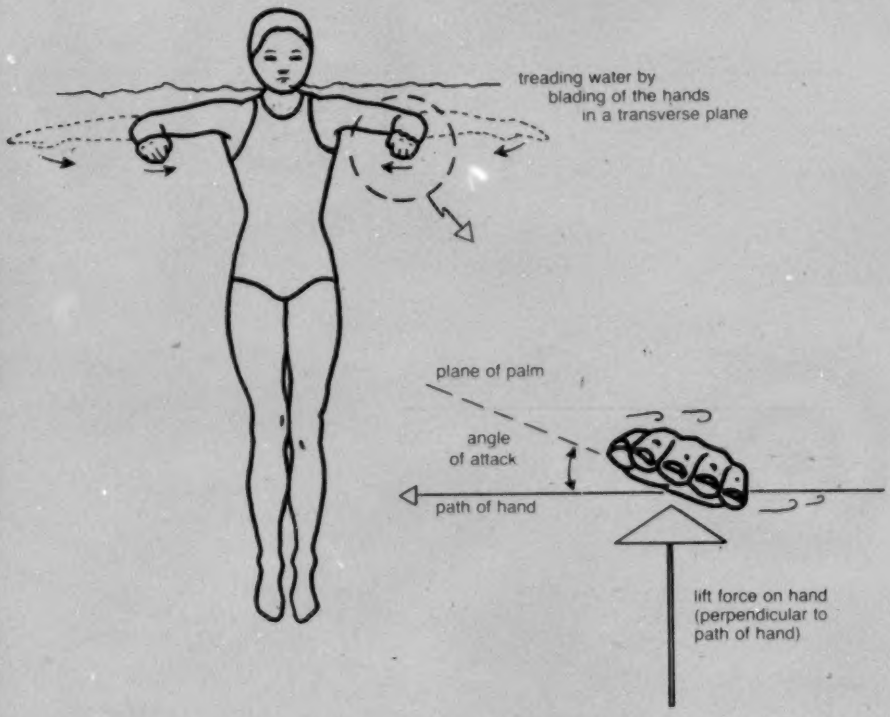


Figure 4. Lift force directed upward on the hands as they blade horizontally through the water. The upward force on the hands with fixation of the shoulder joint muscles serves to support the weight of the head.

and the body can be moved over a greater distance per arm "stroke" by the contraction of the shoulder muscles. Simultaneous front and side view films of skilled swimmers reveal that the hands employ transverse blading movements in a section of still water in order to form such a handle which the swimmer uses to pull the body forward with each arm cycle. The hands are observed not to move directly backward through still water, although that is usually the impression the swimmer has.

Figure 5 shows the formation of blading handles during elbow flexion in the breaststroke, butterfly, front crawl and back crawl. Anatomically, the best opportunity for performing the transverse blading of the hands coupled with the most forceful contraction of the shoulder muscles occurs when the upper arm moves through the middle part of its range of motion at the shoulder. At this time most of the lift force on hand is in the direction of desired body travel (horizontally forward). Moreover, it is during this phase of the arm stroke in which the swimmer's body exhibits the greatest forward response to the arm movement, observed in the front crawl and butterfly when the elbow is flexing and extending under the body. In the back crawl, it is seen when the elbow is flexing in a transverse plane next to the body at shoulder level and

a) blading of the hands during the insweep in the breast stroke or butterfly
b) blading of the hand during the bending of the elbow in the front crawl
c) blading of the hand during the bending of the elbow in the back crawl

Figure 5. Lift force directed horizontally forward on the hands as they blade through the water in a transverse plane. As the shoulder muscles contract, the body is pulled forward through the water past the hands, since the lift force on the palms prevents backward slipping of the hands thfough the water.

in the breaststroke when the hands blade outward and then blade inward. A blading handle is also observed in the leading arm of the sidestroke as the elbow is flexing to move the hand in a transverse plane under the head and shoulder.

Although a discussion of leg strokes is not intended, a brief statement on the breaststroke kick is warranted at this time. Just as blading hands form handles for pulling the body forward, similar use is made of a section of water by the feet in the breaststroke kick. As the hands finish their blading, the feet are brought forward through the water to place them in a section of water behind the hips. Then, the spiraling, blading feet create lift force which is felt as pressure on the soles. The lift force on the blading feet forms what might be termed a "force wall" which serves as a base against which the legs extend and push the body forward through the water. The arm and leg cycle is then repeated, with the arms seeking blading handles and the feet seeking force walls.

Summary

An understanding of the forces developed from the interaction of the body and its parts with the surrounding water serves as the basis for valid stroke analysis. Traditionally, propulsive movements of the arms and hands are examined relative to the swimmer's body, rather than relative to the resistive medium. If the limb movements are not analyzed relative to the section of still water in which they occur, important aspects of force production frequently go unrecognized. Contrary to popular opinion, the blading movements of the hands in the body's transverse plane should not be considered symptomatic of muscular weakness. If it is kept in mind that the body should be moved forward relative to the hands, rather than the hands moving backward past the body, the importance of the blading handles is evident. If the propulsive movements are to result in appreciable forward motion of the body for each stroke, the total body drag must be minimized. By reducing the three types of drag, with emphasis placed on reducing profile drag, the body can be propelled with much less effort and stroke efficiency can be increased.

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ROUTINE DEVELOPMENT

JACKIE DOUGLASS

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Synchronized swimming routines are composed of a variety of figures, hybrids (original figures), and stroking and propulsion techniques performed to music. These elements are joined through the use of transitions and pattern changes. Transitions are surface movements or mini-hybrids which enhance the flow from one routine element to another while also serving as an effective means of changing direction. Pattern changes involve variations in the direction of movement on the water surface (pool pattern). In group routines, pattern changes also consist of variations in the placement of individual swimmers in relation to one another. The attempt to select and link a certain number of these elements together in the manner that best interprets the music is the foundation upon which a synchronized swimming routine is developed.

The Preliminaries

Selection of appropriate music is the first step in choreography. Although there are no rules to the effect, synchro routines are usually performed to standard orchestrated works. In narrowing down the vast amount of music from which to select, consideration should be given to the skill level of the swimmers, the type of routine being composed (solo, duet, trio or team), and the objective behind the routine (competitive or show).

Novice swimmers are well suited to pieces with a medium tempo and a steady rhythm. Marches and Broadway tunes are examples of acceptable music, although there are numerous areas from which to choose. Highly skilled swimmers are able to handle music of a greater magnitude, an extreme tempo and a complex rhythmical pattern and frequently choose to display their skill with interpretations of classical and semiclassical works.

One guideline is that the music should not appear stronger than the performers. A soloist is much more likely to appear overpowered by a grandiose piece than is a team of eight. Conversely, a team of eight might easily appear too powerful for some ideal choices in solo music.

When timing is the factor under consideration, soloists have a much wider choice than do groups. The soloist is free to swim to an abstract piece with arhythmical timing while a group requires music that everyone can easily hear the same for ease in synchronization.

After the music is chosen, it may need to be edited onto a separate record, reel-to-reel, or cartridge in order to maintain a reasonable length for the routine while including the most desirable portions of the music. Editing should be kept to a minimum, especially by the inexperienced, because it is quite possible to produce an overly choppy effect with too many splices.

A number of other decisions can be reached before choreographing the routine. First, listen to the music and develop a feel for what it expresses. Place any required figures that will be included in the routine, keeping the water depth in mind to avoid a vertical descent in three feet of water. Continue listening to the music and try to place

other figures and hybrids. Consider high points in the music and how they can most effectively be used. Listen for sections that may be difficult to count and decide possible ways to alleviate the problem.

Next, decide the type of stroke variations to be used. Does the music have an international flavor to be interpreted? Should movements be lyrical or dynamic?

The starting position of the routine and the general pool pattern can also be decided in advance. A team routine will commonly begin along the shallow end while other routines are just as likely to start at either end. Although it is unusual to begin along the side of the pool, this remains a matter of personal preference.

Developing the Routine

There are several ways to proceed with the actual choreography of a routine, each system having inherent advantages and disadvantages.

Choreographing the entire routine at once before putting it in the water for practice and revision is one workable method, especially with swimmers of novice or intermediate skill and when time is of the essence. The choreographer should be aware of the number of counts required to best execute the movements placed in the routine and should be able to estimate accurately how far the swimmers will be traveling on stroking and propulsion sequences. The swimmers should be gaining in strength and skill as the routine progressses, so it is wise to allow pool space for this when planning stroking sequences.

On-the-spot choreography (in the water) is best handled by a highly skilled group of athletes who welcome the challenge. The routine has a good chance of being fresh and creative as there are so many from whom to draw ideas. However, extensive time can be taken to complete a routine in this manner. The coach must be able to keep firm control of the situation and sort out the good ideas from the bad to assure success. Do not be afraid to make changes and discard an idea that doesn't work when necessary for the overall good of the routine.

These problems might best be controlled by approaching the routine sectionally on land. A segment can be written and then placed in the water to try out before continuing on to the next part. Such a method is excellent for most groups to develop the routine. Most revisions can be made before development has been carried too far. Another advantage is that the coach-swimmer relationship in regard to contributions is quite flexible. The coach is able to control the routine's development, but the swimmers also have a chance to offer suggestions, many of them viable.

Regardless of the manner in which the routine was initially put together, final revisions very likely will be necessary. These may be major or minor, depending on how well the routine was initially developed. At this point, the routine will ideally be at a stage of preparation where only head turns and other minor finishing touches are needed.

A routine might have a more deep-rooted problem than the need to provide polish. One objective way to examine the choreography is to use, as checkpoints, those factors included in the content score of a competitive routine.

Routine Content

The content score involves synchronization and construction of the synchronized swimming routine. Listed under construction are creative action, fluidity, difficulty and variety. Out of a composite 10 points, relative weighing of each factor differs in solo from duet, trio and team events.

	Solo	*Duet, Trio, Team*
Synchronization	1	4
Construction		
Creative Action	2	1
Fluidity	2	1
Difficulty	4	3
Variety	1	1
	10 points	10 points

Synchronization

Credit for synchronization is given in two different ways. Harmonizing movements of the body to the accompaniment is one type of synchronization to consider. Vertical lifts should occur as the music lifts and the body should descend as the music descends. Spins are most impressive during swirling music while ballet legs are especially suited to a percussive background. Although skillful interpretation of the music is especially important in the solo event, all routines should show mastery of this facet of synchronization.

Duets, trios, and teams have another major area to consider as well — synchronization of the swimmers with each other. Not only should every figure, hybrid, stroke, and kick be performed simultaneously, but each of the above should also be performed in exactly the same manner.

Synchronization is probably the single most important factor from a viewer's standpoint and it cannot be overemphasized. Never sacrifice synchronization in an effort to add something else. Credit, for example, is more likely to be given for similarity of performance than for creativity or difficulty.

Construction

Creative action is one criterion to look for when evaluating construction. The key to creativity is found in the consideration of a routine from the standpoint of its uniqueness. A unique body position, a unique transition from one body position to another, a unique float or team pattern, a unique transition from one pattern to another, or even a unique way of synchronizing a movement to the music can add the element of creativity.

The very nature of creativity makes this quality difficult to attain and to maintain. Some moves may start out as unique ideas but if well received will be gradually adopted by others, thus causing them to lose the very creative aspect that first made them popular.

Fluidity entails the use of transitions to move smoothly from one element in the routine to another. The pool pattern also indicates fluidity by showing good use of the entire pool area without harsh or abrupt direction changes. Of major importance in the evaluation of fluidity is the performance of all movements with relative ease rather than the jerkiness associated with undue effort. This is one reason that the general execution of the routine shoudl be given top emphasis. A simple routine that is performed well is much more pleasing to behold than a complex routine that is performed poorly.

Difficulty is best judge on a continuum basis. Figures, hybrids, strokes, floats and patterns may all range from basic to superior difficulty. Difficulty in figures and hybrids might consist of performing a specialized movement technique such as a spin. It might involve the ability to move the body through a variety of planes and positions,

or it might involve possession of extraordinary strength to maintain a position. Difficulty in stroking and propulsion is evidenced by the ability to maintain smooth flowing movement, even as one or both arms are held out of the water. Maximum travel in a routine is also indicative of difficulty. It is much easier to remain fresh and rested for the performance of figures when minimal travel has occurred on stroking sequences. Team floats become more difficult as fewer hands support the float through sculling. Team patterns in which the swimmers are expected to maintain a straight vertical, horizontal, or diagonal line are far more difficult than spread out patterns.

Unfortunately, difficulty is not easy to recognize. As a choreographer, try to learn what is difficult so that the swimmers are given only as much as they are able to handle.

Variety, on the other hand, is easily recognized. To assure a routine of variety, include at least a representation of as many different moves as possible. The variety of the routine will be able to increase as the skill level of the athletes increases. Verticals, spins, twists, splits, walkouts and rotations can only be added to the extent that they can be performed but even a novice can show the beginnings of these positions.

The use of the above factors as a final checklist should enable the choreographer to pinpoint any sections needing correction, thus completing the development of the synchronized swimming routine. All that is required now is concentrated practice to bring the composition as close to perfection as possible.

ACHIEVING EXCELLENCE IN ROUTINE CONTENT

MARGARET M. SWAN

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Content is the word that is now used for "style" in the construction of a synchronized swimming routine. Style may be defined as that elusive quality that causes a routine to be outstanding and to be remembered. At first glance, it might seem that style is difficult to achieve, but, as in all matters of good taste and creativity there are certain ground rules that will help. Content (or style), according to the AAU *Synchronized Swimming Handbook*, includes certain basic criteria: (1) synchronization — one with the other and also with the accompaniment; (2) construction of routines — creative action, fluidity, difficulty, and variety. These factors include such elements as diversity of movement, performance of difficult and interesting movements, originality, propulsion, and pool pattern. Since it is almost impossible to consider each of these factors separately, without going into another, I shall not attempt to do so.

Although the word "art" is studiously avoided by most shychronized swimming devotees, the development of the body into an instrument for beautiful expression of human movement is certainly an art, just as in dancing, gymnastics, skating and diving. This is perhaps most clearly illustrated by the fact that in selecting music for soloists, there are certain types of music that are best for certain swimmers. The sum total of the way a swimmer moves — her hands, arms, feet, legs, body, head and her natural rhythm — becomes a personal style, and in this context style and execution are closely correlated. If an ethereal airiness or decisive strength is best projected, the swimmer must be allowed to express individual spirit and personality. As technique and strength develop, more difficult and unusual movements may be used. Emphasize the swimmer's best points in a routine. If, for example, a swimmer has an excellent split, use figures and hybrids that display this. Duets and teams are the fusing of individual styles into a group style. Because of this, movements in duet and even more so in teams, are generally more mechanized and definite.

A great amount of time is spent by top competitive teams in the development of arm and hand movement, just as done by the dance choreographer. Much thought and effort goes into creating original and exciting hybridized figures. If this is not artistic creativity, someone needs to produce a suitable synonym! Of course, this does not detract one iota from the fact that the body must be developed to the zenith of athletic strength and endurance! Persons in synchronized swimming must first of all be superior swimmers, with perfection in all four competitive strokes.

Music Selection

One of the first considerations is that of music selection. If one wishes to use free rhythm without a definite beat, this should be confined to solo selections, or occasionally to duets. A team routine should have a reasonably definite beat for ease of

synchronization. The music itself should be of good construction, well orchestrated, and devoid of boring repetitious passages. This fairly well eliminates rock and roll and similar types of music. It will be found that certain orchestras and conductors are quite reliable choices. It is very rare to find a piece of music that is just right for a routine without editing and cutting. It is not possible to cover this area here, but generally albums of suites, symphonies, etc., will be most suitable for cutting together. Make cuts so that there is variety in speed and the dynamics of the music for good and interesting accompaniment and to show the versatility of the swimmers.

Be sure to use fast movement with fast music. As a general rule, use at least every other beat of music. Nothing is worse than slow movement to fast music. Don't be afraid of fast music — it is easier to synchronize a team to fast music than to slow where a beat is drawn out so long that there are many spots within it to do a movement. Don't necessarily complete a movement at the end of a phrase of music. It is interesting to halt midway, arresting a movement in midair, so to speak, and finishing it with the next phrase of music.

Choice of Figures

In order to achieve good synchronization, second only to proper music selection is proper choice of required figures. It goes without saying that in planning pool pattern, sequences of shallow water figures and hybrids should be alternated with sequences for deep water, so that swimmers will not find themselves bolting for deep water to do a flamingo, or, worse, trying to do it in shallow water! Do not "waste" deep water by doing a shallow water figure in it. Deep water is precious — save it for thrusting, spinning and twisting figures and hybrids. As a general rule, figures should be selected with the idea of not going over the 1.8 difficulty requirement, especially for a team routine. Furthermore, only the five required figures should be "pure" figures; all others should be hybridized. If spins and twists are to be included in a routine — and they should if the swimmers can handle them well — put them into the hybrids. There is no penalty for failure to complete the spin on a hybrid. As a rule, select figures that are done quickly and are easy to synchronize. Most teams have some figures that they do better than others. Be sure to use these. On the other hand, it might be possible to plan one tremendous required figure, such as a flamingo, spinning 360°. It would be well to utilize its dramatic impact if the figure is appropriate to the swimmer's ability and the content. This will enable the team to use one or two much easier required figures.

Be sure to make the routine move. Stretch the first length of the pool at least 20 feet farther than you dream the team could ever move and then insist the team do it. The swimmers will soon find that they can! Usually teams should move only up and down the pool. If they are moving as they should, there will not be room for much side movement. In a five minute routine, the team should try to cover the pool four to five times. Solos and duets are an entirely different matter and should make diagonal passages across the pool as well as straight up and down.

Use some standard swimming strokes in a routine with the proper kick. Watch the height of the swimmers in the water. It is very easy to become careless when working hard on synchronization in the matter of swimming high. It is also important that swimmers practice projection. It is next to impossible for swimmers to project beautifully in competition or demonstration when they are not in the habit of doing so. At a clinic recently, several routines were being demonstrated for criticism. One of the duets was asked to repeat the routine without any changes except to project. It was amazing what this did for the routine in terms of height of swimming and even in overall extension during figures. The score would have risen appreciably, if it had

been judged. Remind the swimmers constantly to make their movements clean and sharp.

Do not repeat anything excessively! Keep the element of surprise in everything. Frequently teams discover or create a really good movement or pattern and then repeat it. It is difficult to let go of something unusual quickly, but that is the very trick that will make it remembered. Do it — move on to something else — leave them wishing that you would do it again and wondering exactly how you did it. Try to think of really surprising things to do — the unusual surfacing, sink or entrance. Don't be afraid to utilize or modify someone else's ideas; there are few really new things under the sun. Furthermore, as you work with an idea it will probably evolve into something entirely different from that with which you started. Coaches should watch their swimmers when they are just "goofing off" in the water. More new ideas can be gleaned from this than can be imagined! Ask the swimmers to repeat what they have done, and they will usually laugh, but many great ideas come from these observations.

Be careful of ups and downs in the water. Do some of the sequences entirely on the surface without going under water, with stroking or other movements. Do other transitions under water. When sinking beneath the surface, do not come back up in the same spot — another element of surprise. However, don't bob up and down excessively.

Plan a really big and important hybrid and/or float, the "piece de resistance" of the routine. Theme is no longer a judging factor in the content score, but as long as music is played, it will suggest an idea, a feeling, a mood, (or a theme) to the listener. Use these thematic ideas to help you to interpret the music, or to start a sequence of thoughts that will give you original ideas for strokes, arm movements, floats and hybrids. Do not use too many "goodies" in one routine, however. Point up a couple of them by some almost stark simplicity, such as plain torpedo sculling, flutter kicking, etc.

Avoid use of the same type of figures and movement patterns in the hybrids and the required figures. If your team does thrusting figures well, for example, it is easy to use this type of movement more than is desirable. Take a good look at the overall planning of the figures and hybrids from this viewpoint. Turn the team loose on creating hybrids, both shallow and deep water ones. Let the team help with the choreography, but give swimmers some basic ideas to work with. The best choreography always comes from group work with many diverse ideas from which to choose. Some people work best choreographing on deck and some do best with the swimmers in the water. Do it the way that is more productive for you and your team.

Team formations should change often. At a recent clinic on choreography, a team was asked to simply breaststroke through different formations of several routines to demonstrate formation changes and patterns. It proved quite interesting to see the many formation changes, some made on top of the water and some beneath. It is also interesting to find how pleasant it was to watch just the simple breaststroking in good formation. It proved again the absolute necessity for novice teams to *keep it simple and within the swimmers' ability level!* Formations should be spread out for more difficult figures. Nothing is worse than a straight line of flamingos with half of the team backing out of line during the execution of the figure. However, have some close formation for interest and contrast.

The very challenge and excitement of our wonderful sport of synchronized swimming is stated very simply in the AAU *Handbook* under *creative action!* Observe the ground rules and enjoy the sport to the fullest by creating!

UNDERWATER SPEAKERS FOR SCUBA INSTRUCTION

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Physical education instructors are taught to describe physical skills verbally, to demonstrate them when possible, and to guide students through initial efforts to learn the skills.

Aquatics instructors have been aware that they operate under a handicap in such situations because the instructor's head may be under water much of the time while demonstrating, and the student's ears are often under water during attempts to perform the skill. It is possible, of course, to have an assistant or a student demonstrate skills while the instructor describes them or emphasizes important points in the performance. It is nearly impossible, however, for the instructor to communicate with the student whose ears are under water.

Fortunately, most aquatic skills require only brief lapses in verbal communication because the student will return to the surface as soon as the oxygen supply of one breath is exhausted or the skill is a surface skill which allows the student to raise her head occasionally.

Scuba instruction, on the other hand, involves a unique pupil-teacher relationship because of the relatively long periods of underwater activity. Constant communication is vital because there are very real dangers that may result from a single mistake in a very unforgiving medium. Visual communication is hampered because the student is wearing a mask which restricts field of vision to a fraction of normal, and the student virtually is blind without the mask or in turbid water.

Scuba instructors have developed a teaching sequence in which they describe a skill verbally on land, demonstrate under water with only pantomime communication, and then watch the students perform hoping that they can communicate by hand signals any necessary corrections in technique.

Most scuba instructors still use this difficult instructional technique, but the use of underwater speakers is gradually beginning to change this teaching pattern. Some Scuba instructors have been using underwater speakers for years, but there seems to be virtually no reference to their use in the literature available today.

There are several advantages to using underwater speakers in teaching scuba. The two most important are increased safety for the student and increased teaching efficiency.

Safety

The dangers inherent in the sport of scuba diving are very real. The national organizations which certify scuba instructors now require all instructors to carry liability insurance ranging from $300,000 to $1,000,000 each.

The reason for this concern is that scuba students in pools only eight feet deep can suffer lung rupture and possible death simply by neglecting to exhale when coming to

the surface. It is virtually impossible for an instructor in the water with 10 students to prevent any one of them from rushing to the surface in panic at any given moment. It is possible, however, for the instructor to minimize the chances of this occurrence by proper training of the students, and by reminding the students frequently that they must breathe normally while using scuba equipment.

The ability to speak directly to the students under water during this critical phase of their training is probably the most important reason for using underwater speakers. It is advantageous to have a soft voice constantly directing, correcting, reminding and reassuring the students by name during the performance of the underwater skills. It is equally important that an instructor or assistant be under water with the students, making the usual signs, and watching carefully for the symptoms of developing panic.

The instructor's job is made more difficult by the restricted field of vision caused by underwater face masks. Detecting signs of panic usually requires that the instructor look directly into a student's face mask to see the expression in the student's eyes. If there are signs of panic, immediate communication is important. In pools with underwater windows the instructor can signal to the associate watching through the window at the microphone, and immediate reassurance can be broadcast to the student by name.

Conversely, by reason of tunnel vision restrictions, it is difficult for the underwater instructor to keep all students in view every minute. Through the use of underwater speakers and an assistant at the underwater window the instructor in the pool can be directed immediately to any student beyond his/her range of vision who has a problem.

Class management and discipline are very important in a sport which involves inherent dangers. Students, though warned about deviating from specified behavior, get carried away with the joy of the sport. It is not unusual for a student to forget his/her limitations momentarily and turn away from the class to try some innovative and isolated activity. In such cases the underwater instructor must spot the deviant, leave the class to swim and bring the student back to the group. An underwater speaker at the surface can call the errant student back before trouble develops and with minimum interference with the instructor's activity.

There are times during a scuba course when students perform skills without wearing a facemask. During such times, unless an underwater speaker is available, the instructor cannot communicate with the student at all. Without a facemask and visual communication even an emergency situation cannot be transmitted. In these instances an underwater speaker is extremely valuable for correction and instruction.

Efficiency

One of the skills taught in all certified scuba courses is called "Doff and Don." It is a sequence of actions accomplished in a given order and in a specified manner. Normally the instructor must demonstrate this series of actions to the class on land so an explanation can be given for each move, its sequence determined, and the reason for it. Probable mistakes and the methods of avoiding them must be explained. Then the students, having memorized the sequence, must go into the water and play "Follow-the-Leader" with the instructor without benefit of verbal communication. By pantomime the instructor tries to correct the mistakes of several students while they practice the skill by themselves.

The use of the underwater speaker allows the instructor to eliminate the land drill entirely. One can sit by the window, or stand on the deck and talk the class through the exercise, step-by-step, while an assistant demonstrates each move on command. This

process, and the ability to make verbal corrections as the students practice, shortens the teaching time significantly. The use of underwater speakers can cut teaching time for a course by as much as 25 percent.

There are times during scuba instruction when learning is blocked for some student because of over-concentration, tenseness and fear. An underwater speaker can enhance the learning process by distracting the student momentarily and relieving the tenseness through some jovial banter.

There are also times during a scuba course when the class may be practicing various skills in different parts of the pool simultaneously. In situations such as this, the underwater speaker is the only means of directing and correcting several different activities efficiently. It is extremely difficult for an instructor to swim under water from group to group and pantomime instructions.

Underwater speakers are also valuable in directing recreational scuba activities. The imaginative instructor can find many ways to use the speaker to referee an underwater game or to play music and instruct an underwater scuba ballet. Its use is limited only by the ingenuity of the instructor.

Open Water

Perhaps the most dangerous aspect of scuba training is the first open-water experience for the students. Certifying organizations recommend that the instructor-student ratio for this phase of the course be cut to 1:1, except under unusual circumstances. At this time, when they are most needed, underwater speakers are least used. Visibility is often very limited and class control is much more critical.

Speakers on the market now are powerful enough to use in open water for routine or emergency signals for distances up to 500 yards. Divemasters responsible for 10 to 20 divers in open water should certainly consider the use of such an aid.

Underwater speakers are gaining rapidly in favor with scuba instructors. To many they are considered an essential tool for instruction and safety.

HAZARDS OF SCUBA DIVING IN SWIMMING POOLS

LEE H. SOMERS

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Scuba (self-contained underwater breathing apparatus) diving is a rapidly developing recreational aquatic sport. Many secondary schools, colleges and universities now offer formal and accredited instruction in scuba diving. Other schools and recreational organizations allow the use of scuba diving equipment in recreation swimming, club activities, and aquatics classes such as lifesaving and aquatics specialist. Unfortunately, many aquatics program administrators, teachers and lifeguards are unaware of the unique physiological aspects of scuba diving. Many are under the false impression that scuba diving injuries are limited to deep water in oceans, lakes or quarries. They are unaware of the potential scuba diving risk involved in swimming pools. Furthermore, most non-divers are unaware of the specific procedures for handling scuba diving accident victims.

Space does not permit a detailed discussion of all the problems related to diving. Consequently, I shall exclude breathing gas contamination, gas narcosis, exhaustion, breathing pattern abnormalities, decompression sickness, etc. Physical injuries from mishandling of equipment will not be discussed. My discussion will concentrate on injuries to the ears (possibly affecting auditory acuity) and the dramatic consequences of pulmonary barotrauma. This material has been published in detail in Somers (2, 3).

Physiological Factors

The human body is designed to function in a gaseous atmosphere of approximately 20 percent oxygen and 80 percent nitrogen at a pressure of about 15 pounds per square inch. Significantly decreasing or increasing the pressure exerted on the body or changing the partial pressure of the breathing medium gases can induce radical physiological changes.

Exactly how much pressure the human body can endure is still unknown. Human subjects have been exposed to pressure equivalents exceeding 2,000 feet of sea water without apparent residual damage. However, the body contains several rigid or semirigid gas containing spaces (middle ear, paranasal sinuses, lungs and airways, and gastrointestinal tract) which, because of potentially restricted openings, are subject to mechanical damage when pressure differentials as slight as two pounds per square inch exist between the internal space and the external environment. Two pounds per square inch is equal to about four feet of water pressure. In other words, significant pressure changes do occur even in shallow swimming pools.

Medical Considerations

Too often people assume that *anyone* can dive with scuba, especially in shallow water or a pool. Potential diving injuries resulting from physical abnormality are

frequently associated only with the ocean environment. Furthermore, most people assume that the university student applying for participation in aquatics activities is "healthy." In a study by Nemiroff, Somers, and Anderson (1) it was shown that as high as 12.2 percent of the university students applying for scuba training in a given term are medically unqualified. Over a six-year period 5.8 percent of all students applying were medically disqualified. Pulmonary abnormalities account for about 50 percent of the disqualifications. The following is a list of disqualifying abnormalities:

1. Otorhinolaryngology: tympanic membrane perforation (chronic); previous mastoid or tympanic membrane surgery; chronic sinusitis.
2. Cardiovascular: history of myocardial infarction; cardiovascular instability (i.e., syncope or arrhythmias); hypertension (sustained and untreated); uninvestigated cardiac murmurs.
3. Pulmonary: chronic obstructive lung diseases including asthma, chronic bronchitis and emphysema; previous thoracic surgery; history of recurrent pneumothoraces; recurrent pneumonias.
4. Musculoskeletal: pathological fractures; chronic discogenic low back pain with neurologic deficit.
5. Nervous system disorders: epilepsy and recurrent syncope.
6. Metabolic disorders: unstable diabetes-mellitus.

Ears, Sinuses and Pressure

The middle ear and sinuses are lined with membranes containing blood vessels. Changing external pressure is transmitted via the blood vessels and body tissues to the membrane lining of these air spaces. Unless the pressure within these spaces is equal to the ambient pressure, a pressure differential exists causing barotrauma, or pressure injury. The average swimming pool is deep enough to induce this pressure differential.

The middle ear is connected with throat by the Eustachian tube, which functions to drain and ventilate the middle ear. When Eustachian tube blockage (by mucus or congestion, tissue overgrowth, local inflamation and swelling) prevents pressure equalization in the middle ear, painful aerotitis media, or "*middle ear squeeze*," may occur, with possible tympanic perforation (rupture of the eardrum). The diver will experience discomfort and pain in the first few feet of descent. Further descent will result in increasing pain, with stretching of the eardrum and dilation and eventual rupture of the blood vessels in both the tympanic membrane and the lining of the middle ear.

Actual rupture of the eardrum may occur with a pressure differential of as little as 5 pounds per square inch, at a depth of about 10 feet. Generally a slight restriction of the Eustachian tube can be overcome by maneuvers for "clearing the ears" such as swallowing, yawning, or exhaling against closed mouth and nostrils (Valsalva maneuver). Inability to equalize pressure may be due to swelling. This condition may result from upper respiratory infections (cold) or seasonal allergies.

The diver is cautioned to use the Valsalva maneuver with discretion. Increased intrathoracic pressure produced during the maneuver will result in hypotension in the normal individual sufficient to induce unconsciousness. Moreover, too vigorous a Valsalva maneuver could result in inner ear trauma from too sudden a pressure change, either by shearing forces or rupture of blood vessels in the inner ear when the stapes foot plate is pulled externally by the sudden pressure change during inflation of the middle ear. This condition could result in vertigo and/or hearing loss.

When surfacing after experiencing ear squeeze, a diver may spit blood which has drained to the throat through the Eustachian tubes. If drainage and/or discomfort

persist, a physician should examine the injury and prescribe treatment. A diver should not re-enter the water until healing is complete. Antibiotics may be indicated to combat infection. The most frequent and most serious complication of aerotitis media (ear squeeze) is temporary or permanent impairment of auditory acuity.

Blockage of the sinus ostia (openings) results in aerosinusitis, or *sinus squeeze*, with painful edema and hemorrhage in the sinus cavities. These cavities are located within the skull bones and are lined with mucous membrane continuous with that of the nasal cavity. The mechanism is much the same as that described for aerotitis media. With normal gas pressure within the sinus cavity and an excess pressure applied to the membrane lining via the blood, a vacuum effect is created within the cavity. Unless the pressure is equalized, severe pain and damage to the membrane will occur. A diver who has experienced sinus squeeze will often surface with blood in his mask or will notice a small amount of blood and mucus discharge from his nose following the dive. Sinus squeeze can be avoided by refraining from diving when there is nasal congestion as a result of an allergy, cold or infection. If discomfort develops in the sinus areas during descent, it may be relieved by the Valsalva maneuver; if not relieved, the dive should be terminated. Following aerosinusitis, infection may develop, as indicated by persistent pain and discharge; medical attention and systemic antibiotics are generally necessary.

Gas-containing structures attached to the surface of the body are potential sources of *local squeeze*. Failure to equalize pressure under the diver's face mask during descent can result in damage to the skin and particularly to the eyes. The mechanism of damage is similar to that of middle ear or sinus squeeze. The most easily damaged tissues are those covering the eyeball and lining of the eyelids and the spaces around the eyeball. Excessive pressure differential may cause conjunctival and even retrobulbar (behind the eyeball) hemorrhage with tension on the optic nerve and possible loss of vision. Subcutaneous hemorrhage and swelling of the facial tissue under the mask may be evident. The condition is avoided by the diver simply admitting air into the mask through the nose. Swimming *goggles* should not be used for diving.

External ear squeeze can occur when the mechanism and conditions are essentially like those of middle ear squeeze. Use of "ear plugs" in the external auditory canal prevents equalization with external pressure. Damage to the tympanic membrane (eardrum) may be equally severe, though the force is applied in the opposite direction. Hemorrhage blebs (blood blisters) may form close to the eardrum and blood drains from the external auditory canal. Ear plugs are contraindicated in scuba diving, even in the shallow swimming pool environment.

Lungs and Pressure

The scuba diver breathes air at ambient pressure. Consequently, when swimming at 10 feet and breathing from the scuba, the diver inhales compressed air at about 1.3 times the pressure as at the surface. This means that there are many more molecules of gas compressed into the same amount of lung space as at the surface. As long as the healthy diver continues normal breathing and does not breathhold while swimming up toward the surface, the expanding air will exit from the lungs through the airways without complications. However, if in panic the conscious diver breathholds (the normal response of an untrained person) and swims rapidly to the surface or if the untrained rescuer brings the victim to the surface without venting the victim's excess air from the lungs, *lung barotrauma* is almost inevitable. A four foot water pressure differential is sufficient to rupture tissue.

In a diminishing pressure situation, e.g., a diver ascending from depth, the air in the lungs expands because of the decreasing external pressures. If the normal exhalation route of the expanding gas is interrupted either voluntarily, as in breath-holding, or involuntarily, from local respiratory tract obstruction, the intrapulmonary pressure progressively distends alveoli and ruptures of alveoli ensue. Localized partial or complete bronchial obstructions include "ball-valving" bronchial lessions, mucus, bronchospasms, etc. Bronchial mucus and irritants, particularly tobacco, are prime offenders. From the point of rupture the gas may dissect along bronchi and enter the mediastinum to create *mediastinal emphysema*. A diver with mediastinal emphysema may experience such manifestations as substernal pain, breathing difficulties, and even collapse because of direct pressure on the heart and great vessels. Cyanosis may be evident.

From the mediastinum the gas frequently migrates into the subcutaneous tissues *(subcutaneous emphysema)*, most often in the neck and supraclavicular region. This will add manifestations of enlargement of the neck, voice changes, breathing difficulties, and crepitation (cracking sensation) upon palpation of the neck and supraclavical region.

If there is a weakened area on the surface of the lung, such as alveolar emphysematous blebs, rupture may take place into the pleural space with the development of a *pneumothorax*. A pneumothorax is an infrequent but serious complication of diving. This may result in partial or total collapse of the lung on the side involved. As the diver continues ascent, the air entrapped in the pleural space expands at the expense of the collapsing lung and may eventually cause displacement of the heart. This is an extremely serious complication because both breathing and circulation are impaired. Manifestations include chest pressure and pain, breathing difficulties, and cyanosis.

The most serious consequence of alveolar rupture is the release of gas bubbles into the pulmonary circulation; and, via the pulmonary vein, left heart, aorta and carotids, into the cerebral circulation. The cerebral area is most frequently affected since the diver is usually in an erect or head up position, and the bubbles tend to rise. Any bubble too large to pass through an artery will lodge and obstruct circulation to adjacent areas or organs. This obstruction is referred to as an embolus.

The wide clinical spectrum of symptoms and signs associated with *cerebral air embolism* include: headache, vertigo, cranial nerve involvement; visual, auditory, and speech disturbances; loss of consciousness, coma, paralysis, convulsions; loss of vital signs, and death. Death results from coronary and/or cerebral occlusions with cardiac arrhythmias, respiratory failure, circulatory collapse, and irreversible shock. The onset of symptoms is dramatic and sudden, usually occurring within seconds of surfacing, or even prior to unconsciousness; the diver may or may not experience discomfort or pain in the chest prior to or during alevoli rupture. The tearing of lung tissue often results in bloody froth at the mouth; however, the absence of bloody froth does not preclude the possibility of air embolism. The only treatment is re-compression.

Rescue of an Unconscious Submerged Scuba Diver

The potential rescuers of an unconscious submerged diver encompass a large group of individuals. Any swimmer, skin diver or lifeguard operating in an area of scuba diving activity may find him or herself recovering an unconscious scuba diver. This is especially true in recreational pools and beach areas where scuba diving is permitted. Assume that the rescuer is not equipped with scuba and that the victim is in water shallow enough to reach the victim by normal surface diving techniques.

The rescuer should dive to the victim, and proceed as follows:

1. Position the victim so that the head may be extended back, thus opening the airway as in mouth-to-mouth resuscitation. This can generally be best accomplished by getting behind the victim and pulling the victim's head back by grasping hood or hair with one hand and supporting the victim under the arm with the other hand.
2. With the free hand, reach around and release the victim's weight belt and, if the victim cannot be pulled from the bottom, inflate the flotation vest. If the victim can be surfaced without vest inflation or considerable delay, do so.
3. Maintain the victim in the upright head held back position throughout ascent. This is vital for the prevention of air embolism or other lung barotrauma. Some advocate placing both arms around the victim's chest or abdominal area and squeezing. This practice is difficult when the victim is wearing scuba.
4. Do not take time to remove the scuba unless it is entangled or is significantly inhibiting handling of the victim. *Time* is of greatest essence in successful rescue and resuscitation.

Once the victim is on the surface, inflate the flotation unit and *immediately* start mouth-to-mouth resuscitation. With the aid of others, systematically remove the diver's scuba equipment without interrupting resuscitation procedures.

First Aid Considerations in Scuba Diving Rescue

Probably the most serious mistake in dealing with shallow water diving accidents is the failure to recognize air embolism. In the more serious situations, although permanent damage of some degree can be expected in all untreated cases, death is generally the consequence of failure to provide for adequate treatment. Air embolism must be considered in diagnosis of almost any abnormal sign or complaint presented by a person who has been underwater with scuba.

Unconsciousness, during or following a shallow water dive, presents a particular problem of diagnosis and management. However, one practical rule can be given, *"an unconscious scuba diver must be considered a victim of air embolism until proven otherwise by medical personnel."* These conditions can coexist with seemingly more obvious causes of unconsciousness such as apparent or "technical" drowning and injury to the head. Spontaneous recovery doesn't rule them out if neurologic defects remain.

Respiratory arrest from any apparent cause must be managed the same as for the unconscious diver if the victim has been using scuba. Obviously, however, the standing rule for first aid if the diver is not breathing must be to start resuscitation *immediately*. With a flotation vest or float, resuscitation can be administered while the diver is still in the water and being returned to the base of operation. Even though apparently normal, a victim resuscitated at the scene *must* be examined by a physician and, frequently, hospitalized. Delayed unconsciousness and possibly death may result from progressive lung damage.

Neurologic disorders short of unconsciousness must likewise be considered as resulting from air embolism in almost every case. Nearly the entire spectrum of central or peripheral nervous system involvement manifestations can be produced or simulated by these conditions. Air embolism nearly always manifests itself during ascent or within a few minutes after surfacing, and the symptoms are usually major. However, it may become evident many hours after the dive and may involve anything from minor local defects to unconsciousness and convulsions.

Bloody froth, coughed up or seen at the nose or mouth, signifies lung injury. When a diver using scuba exhibits this symptom, particularly if associated with neurologic disorders, the diver is probably a victim of air embolism.

Unconsciousness, respiratory arrest, neurologic disorders, and certain associated manifestations are indicative of air embolism. Symptoms are dramatic and sudden in onset, and brain damage or death can result in a matter of minutes; recompression is the only proper treatment. However, in applying first aid, dramatic relief from symptoms of air embolism may be achieved by turning the victim slightly on left side, in a 15-degree head-down position. This technique is successful in the increase of intravenous pressure, dilation of the venous system and capillary bed of the brain, dislodgement and dispersion of emboli, and restoration of circulation.

The tilt technique is *not* considered a substitute for recompression, but as a slight modification of the standard position used in first aid for a victim of shock. The victim is kept in this position while enroute to a recompression facility, and resuscitation may be administered in this position if necessary. Be alert for vomiting. *Administer oxygen* to the victim throughout transport if possible. Mediastinal and subcutaneous emphysema and penumothorax are often associated with air embolism. If symptoms of these conditions are indicated, consider the diver as a victim of air embolism and take appropriate first aid measures. If the victim has difficulty breathing in the tilted position, lower the body back to a horizontal position; lowering the head only over the edge of the stretcher may be beneficial. If head injury is evident, use the tilt position only at a doctor's direction. The proper action for almost all diving casualties can be summarized in four simple statements:

1. If the diver isn't breathing, start resuscitation immediately.
2. Acquire medical attention at once (unless the injury is a mild or simple condition).
3. If the diver is injured, give appropriate first aid (combat shock; head down, tilt position).
4. If there is any possibility of air embolism, arrange for immediate transportation to a recompression facility; keep victim in a head down position (slightly on the left side) and administer oxygen.

Unfortunately, most hospitals are not equipped to treat diving-induced air embolism. Many physicians are not familiar with the specific ramifications associated with scuba diving injuries. All personnel responsible for the health and safety of scuba diving students or recreation participants must know the (1) location of the nearest recompression treatment facility and (2) physicians knowledgeable of diving accidents. Do not expect local emergency medical personnel, hospitals, or physicians to have this information. Contact local scuba diving instructors, diving clubs, scuba equipment supply stores, or law enforcement authorities for this information. Be certain to personally confirm information from the above sources. Many "authorities" are misinformed on chamber and diving physician availability. The following information should be posted at all aquatics facilities:

1. Name, location and telephone number of nearest physician with specific knowledge of management of diving injuries.
2. Location, telephone number, and contact person for the nearest hyperbaric chamber.
3. First aid procedures for suspected pulmonary barotrauma.

Recompression and Hyperbaric Chamber

It is absolutely essential that a victim of an air embolism be treated by recompression as soon as possible following the appearance of symptoms. In cases of air

embolism, the brain is frequently involved; when it is, the symptoms are usually extremely serious and, unless the victim is recompressed immediately, death or permanent damage may follow even a short delay. Transportation to the nearest facility equipped with a hyperbaric chamber must be made by the most rapid means available. When the distances are great, an ambulance is generally not the most rapid transportation available. Under such circumstances, efforts should be made to obtain a helicopter or other airborne conveyance. Flight at *low* altitude will not appreciably aggravate the victim's condition and is of minor consequence when the alternative is delay.

The technical and theoretical details of treatment by recompression will not be reiterated here. The purpose of recompression is to provide prompt and lasting relief from symptoms of air embolism. Recompression procedures are designed to reduce the obstructing bubbles to a size at which they become asymptomatic and to ensure that no bubble becomes symptomatic upon subsequent decompression. Initial treatment pressure is equivalent to 165 feet of sea water regardless of the diver's depth during the accident. Gradual decompression requires several hours. Proper treatment must be conducted under the auspices of specially trained personnel. Improper or inadequate attempts by untrained personnel to recompress a victim may result in even more severe damage than the initial manifestations.

The layman is cautioned against attempting to administer recompression. Such action without supervision by a licensed physician can involve risk, not only of harm to the victim but of legal complications, both civil and criminal. Attempts to recompress the victim by submerging the diver underwater at the dive site are considered fruitless and hazardous. *Do not* attempt in-water treatment.

In the event that the local physician is unfamiliar with diving and the availability of hyperbaric chamber facilities, a 24-hour-a-day emergency diving advisory service is maintained by the U.S. Air Force at the School of Aerospace Medicine at Brooks Air Force Base, San Antonio, Texas. In an emergency, simply dial the San Antonio area code (512) and then the letters which appear on the telephone dial spelling out the words LEO FAST.

Conclusion

Many aquatics instructors and administrators lack specific knowledge of scuba diving. Consequently, scuba diving activities are frequently conducted without adequate provisions for qualified supervision, rescue, first aid, and special treatment requirements unique to scuba diving. Prospective rescuers must have specific knowledge of the physiological implications involved in the rescue and subsequent care of scuba diving accident victims. Improper rescue procedures and first aid may result in a number of medical complications leading to the possibility of permanent paralysis of various portions of the body or death. Serious accidents *can and do* occur in shallow water and swimming pools.

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DEEP WATER RESCUE BREATHING*

ALBERT L. PIERCE

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What can you do? You've just found your snorkling buddy on the surface in open water, *not breathing*! If you tow him to shore he may be dead before you get there. He needs air — and fast! But how? Mouth-to-mouth rescue breathing has saved many lives on land. But can you breathe air into the mouth of a limp unconscious person when the water is so deep you can't stand on the bottom?

If you swim, snorkel or scuba dive in open water, as more and more people do these days, you owe it to yourself and your buddy to learn one or both methods of deep water rescue breathing. Mouth-to-mouth is uncomplicated and easy to learn, but without flotation or fins it is very tiring to continue. In contrast, you will not get tired giving air, mouth-to-snorkel because you don't have to lift your head above water. A few minutes' practice is usually enough to perfect making a good seal over the victim's lips with the snorkel mouthpiece.

Mouth-to-Mouth

If you are a good swimmer and can tread water well, you can give a few breaths of air to a non-breathing victim, mouth to mouth, when no equipment is available.

1. Start with a chin pull and turn the victim's face up. Using your free hand, turn the head, pull down the corner of the mouth and let any water drain out. (Figure 1.)

Figure 1.

Illustrations (Figures 1-9) are by Robert Betof.

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2. Hook your free arm over the victim's near arm and place your hand underneath the back. If you can, cradle the neck between thumb and forefinger of that hand. (Figure 2.)

Figure 2.

3. Release the chin pull and press with the heel of that hand on the victim's forehead, tilting the head back for an open airway. You can easily pinch the nostrils then with your forefinger and thumb (Figure 3.)

Figure 3.

4. Turn the head toward you.
5. Seal your mouth over the mouth and blow.

In the initial chin pull position (which may precede both mouth-to-mouth and mouth-to-snorkel methods), the victim's head should be held firmly in the crook of your arm or against your chest to prevent the victim from floating or drifting away. Kick at an angle toward the victim's feet and your forward momentum will keep both your faces out of the water.

Your mouth should be opened wide and pressed down tightly over the victim's lips, and the seal kept tight while blowing to fill the lungs with air (like blowing up a balloon). You can feel the pressure building up in the victim's lungs, so you know he or she is getting air. If you feel a blockage, tilt the head back more. In your initial effort, try to get four quick breaths into the victim without allowing him/her to exhale fully. In practice, blow gently at first. If you puff air into a conscious victim's throat with a strong gust, he or she will probably block the flow of air whereas an initial gentle pressure will encourage the victim to open the throat and allow the lungs to be filled with your expired air.

Turning the victim's head toward you allows you to seal your mouth over the victim's without lifting your head high out of the water. If you don't turn the head, the weight of your head above the water may force the face under before you can make a good seal. However, it won't matter is the face is accidentally submerged if you have made a good seal first. Although you can blow air into the victim while both heads are under water, be sure the face is above water before you release, as water in the mouth may cause a spasm or go into the lungs.

The arm-over-arm position (called the "do-si-do" in square dancing) affords excellent control of the victim. It can be done equally well from the right or left side. (See Figure 2.) If two rescuers are available, both can hold the victim in the "do-si-do" with one rescuer on each side. One can help support and tow while the other gives mouth-to-mouth. When one gets tired; they can switch. If a third rescuer is available, he or she can place the victim's feet on his/her shoulders and push. (Figure 4.)

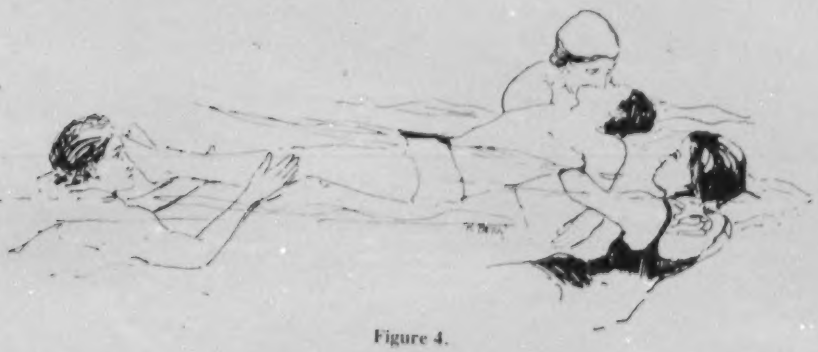

Figure 4.

When you are adept at mouth-to-mouth in shallow water, try it in deep water, first using fins or flotation. Fins will allow you to kick high enough to place your mouth over the victim's mouth. The buoyancy of an inflated life vest or buoyancy compensator on the victim helps to keep the victim from sinking when you make mouth

contact. Skin and scuba divers normally have this equipment. You may or may not wish to inflate your own jacket. If both are inflated you may not be able to get close enough for good mouth contact. If this happens, release some of the air through the oral inflator tube. Practice with jackets will show how useful they might be. The extra bulk of even one inflated jacket will make towing more difficult, especially against a current.

Dropping the victim's weight belt also adds buoyancy, but be sure to get some air into the victim first. Gear manipulation or removal should be done only after initial or subsequent attempts to give air.

Once you are confident of giving mouth-to-mouth in deep water using flotation, you should try without added buoyancy or fins. This is very difficult, but even one breath may be enough to keep a drowning victim's heart going.

Scuba divers should practice in full scuba gear, but can start by wearing only wet suit gloves. They will make the fingers feel clumsy initially, but with practice it will be easier. Practice should be continued in open water under varied conditions of waves and current.

Mouth-to-mouth rescue breathing is fast and requires no equipment, but without flotation or fins it is difficult and very tiring. Even a strong swimmer has trouble giving more than a few breaths. What you need is a way of giving air without lifting your head high out of the water. So, if you are going to give your drowning buddy air, mouth-to-mouth, skip your mask strap, with snorkel attached, over your arm. You're going to get tired and you can use that snorkel!

Mouth-to-Snorkel

A snorkel enables even a weak swimmer to give air in deep water while towing a victim to safety. Here's how:

1. Turn the victim's face up with a chin pull. Using your free hand, turn the head, pull down the corner of the mouth and let any water drain out.

2. Clear water from your snorkel by letting it run out or by blowing it out. Keep it clear by bending the tube end up or by holding it in your teeth. A one hand way of clearing the snorkel is shown. (Figure 5.)

3. Release your fingers from the chin pull to receive the snorkel mouthpiece between your middle and ring fingers. Keep control of the victim's head by holding it tightly against your chest, using your wrist. (Figure 6.)

Figure 5.

Figure 6.

4. Press the snorkel flange over the victim's mouth, sealing it tightly all the way around. Use your right hand (or left, if you are left-handed) to make a better seal.

5. Pinch the nostrils with your thumb and forefinger and blow into the tube. You'll have to blow a little longer than for mouth-to-mouth to overcome the snorkel's dead air space. (Figure 7.)

Figure 7.

6. After giving a breath, remove the tube end of the snorkel from your mouth and allow the victim's exhaled air to escape through the tube. You will not be able to see the chest rising and falling, but you can hear and feel the exhaled air.

7. If your seal at the mouth or nose is imperfect, you will feel air escaping around your fingers and will notice a lack of build-up of pressure as you blow. If so, you are not filling the lungs and you must re-adjust your fingers to make a better seal. If you feel an air blockage, tilt the victim's head back more to open the airway or look for obstructions in the victim's mouth.

8. Continue blowing and releasing as you tow the victim to safety. On your back, you are positioned well for a carry.

You should fill the victim's lungs with each breath. This will insure you are overcoming the snorkel's dead air space. When the victim stops exhaling you can immediately blow back into the tube to refill the lungs. Although this will not hurt a drowning victim to receive air at a rapid rate, the rescuer may become dizzy from hyperventilation. If so, slow down the rate. Of course, while the victim is exhaling, you are inhaling, being careful not to breathe in the victim's exhaled air.

To block air from escaping, you may be able to push up against the victim's nose with the edge of your index finger, instead of pinching the victim's nostrils, to make a better seal with the snorkel flange over the mouth. (Figure 8.)

Figure 8.

An almost perfect seal will result if the snorkel flange is inserted between the victim's lips and teeth. This is not easy to do on an unconscious victim, and you may waste time trying. If the flange is pressed tightly over the outside of the lips, a sufficient seal can be effected quickly. Practice by pressing the flange over your own mouth. You can test for leaks by blocking the tube end with your thumb as you blow. If you cannot make a good seal with the flange over the outside of the victim's lips, try twisting or screwing the flange into the mouth. Your seal does not have to be perfect. The victim may be getting plenty of air even if some escapes. The real test of a seal is whether the victim is comfortable while submerged. This will simulate waves swamping the victim as you tow. If you practice with a victim's face submerged, be sure to have a pre-arranged signal so you will know the seal is effective! (See Figure 8.)

Most snorkels will work, including contoured types and those with corrugated tubes, but some are better than others. Either the mouthpiece or the tube, or both, must be flexible to allow you to aim the mouthpiece down over the victim's lips and still keep the tube end out of the water. Check your snorkel and see how it works. Some are too inflexible and can't be used. If it is too long it may bend and pinch off the air flow. A wide flange will help to make a better seal when pressed over the victim's lips. Learn first with an easy snorkel. Later you may find you can make a good seal with almost any snorkel. Snorkels with purge valves will work if you prevent the air from escaping out of the valve by covering it with your hand. Air can be released for exhalation, through the valve. You will have to use both hands and hold the snorkel tube in your teeth. Be careful not to inhale the victim's exhaled air. (Figure 9.)

Figure 9.

With the tube end of the snorkel in your left (or non-preferred) hand, the curl at the bottom of the "J" formed by the snorkel should be oriented so that the mouthpiece is aimed toward the fingers of your right hand to allow easy control of the tube end on the left of the victim's head while you are holding the snorkel flange over the victim's lips with your right hand from the right side. (See Figure 6.)

If you need to use a snorkel which is tightly attached to a mask, don't bother to separate them. Just let the mask dangle. It won't be in the way. If the victim is wearing a mask, and you are sure it is clear of water, it may be left on to protect his face from waves and spray. You can seal the nostrils by pinching through the mask or by pushing up on its skirt or purge valve, depending on the type.

If the victim vomits, remove the snorkel, clear the mouth, swish the snorkel through the water to clear it, let it drain, and start over. Vomitus in the lungs will kill.

Practice mouth-to-snorkel first on land. The seal is tricky because you can't see what you are doing. Locate the victim's mouth with your fingers. With your little

finger on the chin, your hand will be about right. Practice applying the mouthpiece until you can do it easily. Your practice victim can help by relaxing the mouth and throat muscles and allowing you to blow into the lungs. It is an interesting sensation for both of you.

Then practice your seal in shallow water. Stoop down until the water is at chin level, while you support the victim with a chin pull. Here you can practice keeping the tube end out of the water while applying the mouthpiece.

When you feel confident in shallow water, try it in deep water. Use a life jacket on the victim and wear fins to allow easy movement through the water so you can control the victim with your hands. Kick with your fins and tow your victim head first through the water. Your forward momentum will float you higher in the water. Then try without fins or flotation.

Scuba divers should practice with full scuba gear. The thick neoprene of wet suit gloves will make your fingers feel clumsy, especially when sealing the mouthpiece, but with practice you may find that the soft rubber helps to make a better seal. Because of this, even three finger gloves or mittens can be made to work.

Keep practicing under varied conditions until you are sure of yourself. Mouth-to-mouth resuscitation has saved many lives on dry land. As deep water rescue breathing becomes part of standard rescue training, many more lives may be saved.

The movie, "Deep Water Rescue Breathing," Albert L. Pierce, 16 mm color, sound, 10+ minutes is available from Pierce Productions, P.O. Box 1037, Westford, MA 01886. Rental is $15, deductible if purchased at $110.

THE EGGBEATER KICK

RUTH JOHNSON

Ruth Johnson recieved her B.A. degree from the State University of Iowa, Iowa City and her M.A. degree from Northeast Missouri State University, Kirksville. A physical education instructor at West High School Davenport, Iowa, she has served as a DGWS Aquatics Rules member, AAU snychronized swimming judge and a National AAU women's water polo chairperson.

The eggbeater kick is a form of treading water that is used in synchronized swimming and water polo. It is a circular pattern of the foot pressing forward, toward the bottom of the pool and recovering around to begin the next cycle. The action of the foot and lower leg is similar to an alternating breaststroke whip kick. The left leg recovers as the right leg delivers the supporting thrust and vice-versa. The thigh should remain as close to a 90° angle to the body as possible. The power comes from a rotation of the thigh in the hip socket.

To eggbeater in the vertical position, the body assumes an erect sitting position with the thighs at a 90° angle from the trunk. Knees remain relaxed and fairly stationary about hip width apart as the lower leg and foot make a circling motion. Back and stomach muscles should hold the trunk in good posture without becoming involved in the kick itself.

The power phase of the right leg starts with the shin to the right of the body and as parallel to the bottom of the pool as possible. The foot is cocked 90° to the shin so that the entire inside of the lower leg and instep of the foot can be used. A strong rotation of the thigh causes the lower leg and foot to begin the thrust. Initial pressure should be directed forward and toward the bottom of the pool. The ankle then begins to extend, toes point inward as the pressure continues toward the center of the body. The toes continue to lead the circle with the sole of the foot pressing. Finally the foot is relaxed as the leg is carried back and up on the recovery to be cocked and ready for the next circle. The student should work to move the beat evenly from one leg to the other for smooth, continuous power. Strong, flexible knees, ankles and hips are important in developing an efficient eggbeater kick.

As the hip rotation becomes smooth and the kick stronger, the pattern of the kick becomes smaller and faster with the action almost directly toward the bottom of the pool. There will be increasingly less finish toward the center of the body.

Steps to Develop the Eggbeater Kick

1. Swimmers should first develop the correct foot action for the breaststroke kick. Practice speed tests of kicking on the stomach with the hands behind the back. Swimmers should be able to keep their chins dry for a minimum of 25 yards.
2. Sit down, keeping a 90° angle at both the hip and knees, swinging the feet as far to the right as possible, then as far to the left as possible. Make the rotation of the thigh in the hip socket.
3. While sitting, begin to rotate one foot inward and around the ankle. Enlarge the pattern by adding movement of the lower leg. Keep the knees fairly stationary and emphasize the thigh rotation. Do this slowly at first, then more rapidly. Change legs.
4. Practice the alternate timing while sitting on a diving board. The lower leg must have free room to come under the body and close to the buttock on the recovery action.

5. At this point the instructor may find it necessary to move the swimmer's foot through the desired pattern of movement. Pressure or resistance may also be used to show the exact time and direction of the desired force.
6. Hang on to the edge of the pool with the back to the wall. Assume a sitting position and practice steps 2, 3 and 4. (Instruction could begin in this position, though workout in the water can be beneficial.)
7. Move away from the wall and eggbeater with hand support. As the pattern becomes smooth and strong, raise the hands; then keep shoulders dry; then with shoulders dry, extend arms fully overhead.
8. Develop additional strength and endurance with timed contests, height contest, patty cake games, passing a brick, or playing catch with a ball. (And, yes, a little water polo. Use one hand on the ball while holding the other hand in the air. Any ball will do at first.)
9. Practice racing across the pool on the stomach, on the back and on the side using the eggbeater. Repeat, aiming this time for maximum height instead of speed.
10. Once skill is achieved, many coaches have swimmers eggbeater during announcements or instruction. These can be as short or as long as one wishes the practice of the eggbeater to be.

YOU GOTTA BELIEVE ...

KATHLEEN S. JOHNSON

Kathleen Johnson has taught and coached swimming at various levels. She is currently employed as head coach of the Westchester Senior High School swim team, in the Spring Branch Independent School District, Houston, Texas. She holds a B.S. degree in physical education from the University of Houston and a M.S. degree from Texas Woman's University in Denton.

I call our sport the "50-meter jungle." The actual arena of competition is just an ordinary rectangle of water, exactly fifty-meters long and twenty-five meters wide. But it is the focus of more clawing, more struggling for power and more parasitism than almost anywhere else in the world of sports.[1]

The "50-meter jungle": what else could possibly take place in the midst of such struggling? Fortunately, a great amount of physical and mental development and building of character. Amid the struggle for power is happiness for those who find success. In this "jungle" it is not guns that decide who is most powerful. Rather, it is sheer hard work and dedication that will bring home the trophy.

What drives an athlete to struggle, search and compete in this atmosphere? What makes an athlete, a swimmer in particular, practice day in and day out? Why do they peer at school books through chlorine-red eyes after a 5:30 AM workout, then return after school for another? It isn't because smeone forgot to turn the heater up and the temperature is 70 while the chill factor overhead is below freezing, nor is it because the aching muscles are begging for more. So what is it? Certainly a love of the sport, the thrill of competition, and the tremendous amount of discipline that is required are factors. But beyond those, what can really get a girl into swimming?

Motivation

A swimmer needs to be supported by a coach who can motivate her to exist in her swimming "jungle." Motivation is the difference between a good athlete and a great athlete. Many great athletes are self-motivators but they still need the coach who knows how to build them up and bring them down. All athletes need a coach who is there and knows what to say when only a few hundreths of a second kept them from being first. Extrinsic motivation comes in different shapes and sizes, be it a lollipop or a pat on the back. Motivation must be consistent and a real feeling. It can make the difference in a crucial moment when two teams have trained with very similar yardage. On our team, it is a type of bond between coach and swimmer, swimmer and team, and coach and team. That common bond was given an identity at a regional meet. The 200-medley relay was about to start; the competition was intense. Our relay team was destined to place fourth or fifth. They wanted to go to state but they were young and they knew the going was tough. But as the saying goes, "when the going gets tough, the tough gets going."

They trained, maybe not hard enough, but hard. When the race was over they were not going to state, but neither were they fifth; they had placed third. Their times had dropped considerably. They were happy. Not completely content, but not disappointed because they had improved. What was it that made these girls pass two other teams which had continually beaten them? What stretched their fingertips to touch

[1]Sherman Chavoor and Bill Davidson, *The Fifth-Meter Jungle* (New York: Coward, McCann, Geoghegan, 1973), p. 5.

only a few hundredths of a second earlier? The answer was given to me by one of the girls as the relay left for the ready bench when she said, "You gotta believe coach, you just gotta believe."

"You gotta believe" — in your team and in yourself whether coach or swimmer. This attitude must be a part of a competitive swimming program. The coach must be able to motivate the swimmers to a third place instead of a fifth. A team can train scientifically, can film and analyze, and can say it might win, and it will most likely fail and with great consistency. You must train and film and analyze and you must believe, in yourself as a coach, each girl as a competitor and in the team as a winner. It does make a difference.

YOU GOTTA BELIEVE COACH; YOU JUST GOTTA BELIEVE!

TEACH THE REVERSE TO BEGINNERS — SIMPLY AND SAFELY

GLORIA PETERSEN

Gloria E. Petersen received her B.S. degree from East Stroudsburg State College, Pennsylvania, in health and physical education. She has been a Red Cross instructor and was a member of the subcommittee on revising NAGWS Diving Rules in 1969. She has been a high school boys' and girls' diving coach, owner of Gloria's Swim School in California, National NAGWS diving and swimming official, PSU men's and women's diving coach, and PSU ladies' swim team coach. She also teaches diving and has coached swim teams at the YWCA and private clubs.

How many times has the swimming coach been pressed into coaching the divers because they were a part of the swim team? Even though swimming and diving are entirely different sports, they are combined in a swim meet because both are water sports. Most swim coaches know absolutely nothing about diving and certainly do not have the time to learn.

Many schools hire a swim coach and perhaps an assistant coach, but few have funds to pay a diving coach. Teaching and coaching a limited number of potential divers seems extravagant since so many more are involved in the swimming program. Divers are kept to a limited number because board time is precious and talent in this area is more quickly observed; those lacking in ability must be weeded out early. Nonetheless, first place on the 1-meter and 3-meter board is just as important as the first place swimmer in two events.

Diving is an all-time consuming sport which requires more time than most coaches can give. Divers must find time on their own to practice, whether it be the approach and hurdle alone (which can be done on a trampoline, pool deck or mini board) or the full approach with required dives. The optional dives should be practiced with the coach overseeing in order to prevent bad habits or accidents.

The following suggestions are offered to help the coach who can spare the time and has a desire to help an aspiring young diver. One of the five required dives which each diver must learn is the reverse, a difficult dive for a novice coach to teach if the correct leverage principles are not applied. Follow this method and your beginners will learn it correctly and safely:

1. Good approach and hurdle — diver jumps high with both hands overhead.
2. When diver nears top, say "Lean!" Diver lets shoulders lean slightly with head in direct alignment.

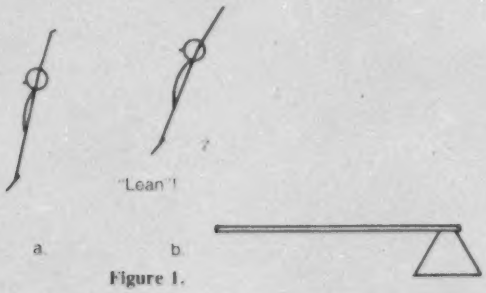

Figure 1.

3. Diver repeats five or six times until lean is consistent, with no arch and getting as high as possible. (Jump must be within five feet of the board end). So, instead of throwing the hip forward off the board, the diver gets full lift upward — slight lean backward, thus getting an exchange of weight very easily.
4. Now, diver jumps and leans; you call "Tuck!" Diver *pulls knees* toward chest, drops head back and has now done a reverse dive — or let the diver stay tucked for the full somersault. For the dive, call "Now!" or something similar, letting your diver know to straighten legs to ceiling — to bring arms overhead for the dive.

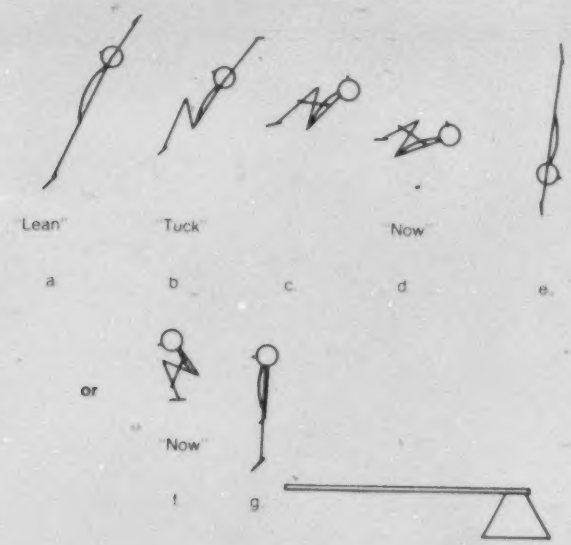

Figure 2.

The diver has learned two dives in one without "fighting" for position and is ready to do a pike or layout reverse dive with basics the same. Eliminate the old "kick the football" technique which has done more harm than good. By pressing from the feet, or kicking forward, the reverse is pushed outward and backward simultaneously, thus hurrying the beginner diver. It inhibits height and an up-and-down rotation. Granted, for the reverse 2 or 2½, some press is needed directly from the board, but not a great deal. The shoulder lean initiates the spin, giving a more rapid rotation and more vertical spin and entry.

ESTABLISHING A YEARLY COMPETITIVE SWIMMING PROGRAM

MILLIE ROBERTS

The author competed in AAU swimming for five years before becoming a member of Arizona State University women's swimming team. While competing for ASU, she was a co-captain of the team that won three consecutive national championships and was undefeated in all meets during those four years. She was named Coach of the Year in Florida and has served as an assistant coach at Arizona State and head coach at Texas Tech University. She is presently instructor of physical education and women's swimming coach at the University of Arizona, Tucson.

When establishing a yearly competitive swimming program it is important to consider the following factors, as they will determine what can be accomplished during the season: (1) the background or experience of the swimmers, (2) how much time per week is available for practice, (3) the number of meets per year or season, (4) the number of times during the season that you will need to taper, and (5) the length of the swimming season.

The background or experience of the swimmers will determine the amount of yardage or work they will be able to handle. Swimmers who have swum either in a strong age-group or high school program will be able to cope with a more difficult training program while less experienced swimmers will need to adjust gradually to the more difficult workouts.

The time allowed for practice each week will determine the yardage that can be swum as well as how flexible a coach may be with workouts. If a coach has the advantage of two workouts daily, the swimmers may enjoy a more flexible training program. Although a conflict with classes or exams can frequently cause a swimmer to miss several practices, it is unlikely that the athlete would be forced to miss both workouts in a day. If double workouts are available, the coach may utilize the first one for a loosening type of practice, and the second one for a difficult practice session, or, the coach may choose to use one practice for stroke drills and the other as a more quantity type of practice. Also, if the swimmers look super, or are a little stale, the coach has the option of cancelling a practice session.

If workouts cannot be scheduled once or twice a day, it is most important that the swimmers be in attendance as much as possible. If they know when practice will be, then each swimmer should be able to schedule classes around practices. The coach should provide some dry-land exercises that could be done on the days that the swimmers are unable to get into the water. In the early season, the swimmers may be running or riding bikes to help maintain cardiovascular endurance. The coach should not let the swimmers feel they will automatically be defeated since they will only be in the water three or four times per week. It is not unusual to see teams that are fresh and excited, defeat teams that are exhausted, bored, and do not care about swimming, much less winning. The coach should make the best use of practice times according to the needs and desires of the swimmers. Just as there is a harm in too little work, there is a greater harm in too much work.

The number of meets that the swimmer will compete in will also determine training techniques. The more meets that are scheduled, the closer the coach must watch the swimmers to be sure they aren't becoming overly tired before the major meets. From my experience as a swimmer and a coach, a meet every two or three weeks is

preferred. Any more than that can lead to an overly tired group of swimmers, and any less can lead to a very bored group. If you are able to schedule meets a few weeks apart, the swimmers should be able to maintain that "competitive hungriness." During the two weeks between meets, the coach will have plenty of time to let the swimmers recover, gain strength and speed, even take it easy a day before the meet. If some meets are scheduled once a week, the coach may have to choose the most important ones and *swim through* the others in order to save strength and much needed speed for the more important meets.

Ideally, it would be advantageous to taper or rest only once a season, however, that is not always possible. Sometimes it is necessary to taper some swimmers before a championship meet in order to meet qualifying time standards, while other swimmers on the same team will have to taper only for the championship meet. Again, the coach must be flexible enough to taper some swimmers and at the same time keep the remainder of the team training hard.

The length of the season will determine how long the coach may keep the swimmers in each training phase. The longer the season, the better condition the swimmers should be in, and, the better their performances.

Training Phases

Basically, there are four phases of training during the swimming season: (1) pre-conditioning, (2) conditioning, (3) competitive, and (4) the taper phase.

Pre-conditioning

During the pre-conditioning phase of training, many stroke drills can be used along with weight training and general body conditioning exercises. One double workout should be sufficient. The object is to develop proper stroke mechanics along with conditioning the athletes before they reach the more difficult conditioning phase. During the early season various activities such as jogging, bicycling, weight training and even water polo will help increase cardiovascular endurance. This time may also be used to establish goals for each swimmer to try to achieve during the season. Take this time to get to know your swimmers!

Conditioning

Gradually, the yardage that is swum should increase until the swimmers are engaged in double workouts and long repetitive swims such as 10 x 500 or 50 x 100 with little rest between each repeat. Since the conditioning phase is probably the most boring and tiring phase for the swimmers, the coach should vary each workout while developing endurance in the swimmers. If endurance is not developed during this phase, maximum performance cannot be achieved at the end of the season. It is also important the swimmers see progress. A time trial 1,000 yards or even a 1,650-yard swim each 7 to 10 days can prove beneficial to the swimmers and the coach. Weight training or conditioning exercises are important. During this phase, the swimmers should be very tired and it will be difficult for them to be excited about swimming, but if they work hard and let their bodies adjust to the work it will pay off in the long run.

Competitive Phase

As the season progresses and the meets draw near, the competitive phase of training begins. After developing endurance during the conditioning period, speed — the objective of this phase — must be developed. Shorter distances are swum for repeats and the rest interval is still short, but is lengthened as the phase progresses. A

typical main series set in this stage could be 20 x 100 on 1:20 or 1:30, or 20 x 50 on :40 or :45. During the weeks of this phase the coach cannot expect to achieve 100% performance from each swimmer during each practice. To prevent over-sprinting, a coach may wish to employ a cycle type of training that would include a day of distance training, followed by a day of mid-distance swims, then a day of sprints. Then the cycle would repeat. The coach must see that the swimmers aren't overly tired and adjusts workouts accordingly. Broken swims and "get out" races are effective and interesting for the swimmers.

Training

The training phase that most swimmers look forward to is the taper or rest phase during which the object is to keep the swimmers fresh, rested and ready to explode with speed the day of the championship meet. Best times should be achieved during this phase. Yardage is reduced drastically and rest between repeats is greatly increased. Broken swims are very effective in this stage. At this point the swimmer wants to be swimming exactly the way she will in the meet. That includes proper starts, turns, stroke mechanics, and finish. Now is the time to apply the finishing touches to a performance. Everything must be perfect.

Normally this period lasts two to three weeks, depending on the length and intensity of the conditioning and competitive phases of training. Coaches must remember to taper the sprinters earlier than the distance swimmers because the shorter the distance to be swum, the longer the taper needs to be.

It is important for the coach to realize that just because one training phase may concentrate on stroke mechanics and conditioning, those techniques must be incorporated throughout the year. The same is true of all phases of training; one overlaps and builds on the others.

Most swimmers like to feel that sometime each day they have sprinted, either on kicking drills, on pulls, or on a 25-yard sprint at the end of practice. Swimmers like the feeling of swimming fast, especially during the pre-conditioning and conditioning phases.

Stroke mechanics are always important because the more efficient the stroke, the greater the chance of an improved performance. Swimmers should practice legal turns at all times. Too many swimmers become lazy and practice illegal turns which become so automatic that they do these illegal turns in a meet.

To help swimmers have their mind set on a great performance and have the confidence needed to swim well, a coach can conduct a "mental builders" workout, probably the most boring, but also one of the most rewarding workouts. It can consist of either 100 x 50's, 50 x 100's, or even 20 x 200's. Whatever the distance, it usually puts a mental strain on the swimmers just to complete it. However, if they can finish 50 x 100's, there is *no* reason why they can't swim one or two 100's hard during a meet.

Throughout the year it is also necessary to develop lung capacity, not merely by swimming and breathing normally, but also by taxing the lungs. No-breather 25 yard swims or underwater swims (never more than 25 yards), or 10-15 yard sprints without a breath all prove beneficial.

There are probably as many different opinions as to the amount of yardage that must be swum as there are coaches. I try to avoid totalling the yardage of a given workout before practice to provide sufficient flexibility to change during practice, if needed. Whenever the yardage was totaled before practice, both the team and I felt we had not accomplished a great deal if that amount was not swum. My belief is that it is

not the quantity of yardage, but rather the quality of effort put into the repeat, that makes a swimmer.

Coaches are aware that all work and no play can be very boring, and swimming on the same black line for countless hours each year can become old very fast. If the swimmers can have fun and want to return to practice anxiously awaiting that day, it will be much easier for you and a lot more interesting for them. Besides, if a team is having fun working hard, they will probably have fun winning!

DOUBLE-DUAL AND TRIPLE-DUAL SWIMMING MEETS

LEE BELROSE

Lee Belrose recieved the B.S. degree from Boston University, Sargent College, and the M.A. degree from Russell Sage College, Troy, New York. She is a water safety instructor, national rated NAGWS swimming official, and former state officiating chairperson of swimming for the New York State Council of Women's Sports Officiating Boards. Presently she is teaching physical education at Plainview High School, Plainview, New York.

To many coaches and officials of competitive swimming, the mention of a double-dual or triple-dual meet often raises questions, such as,

What are double-dual and triple-dual meets?
What are the advantages of double-dual and triple-dual meets?
How do you structure and score these meets in order to avoid confusion?

Definitions

In a double-dual meet, three teams swim at the same time and two meets are scored.
Team A competes with Team B.
Team A competes with Team C.
In a triple-dual meet, three teams swim at the same time and three meets are scored.
Team A competes with Team B.
Team A competes with Team C.
Team B competes with Team C.
In a triangular meet, three teams swim at the same time and one group meet is scored.

Uses of Double-Dual and Triple-Dual Meets

The following suggestions are a few of the uses to which the double-dual and triple-dual meet may be of benefit:

1. The basic double-dual and triple-dual meet structure and scoring are the same as a dual meet conducted in a 4- or 5-lane pool. Therefore, they may be used as part of a regular league schedule where a win-loss record is kept.
2. Where distances between teams make it difficult to compete, a triple-dual meet at a centrally located facility may be taken into consideration.
3. Where facilities are limited, multiple use of the available pools may be an important factor in scheduling.
4. When the length of the season allowed for competitive swimming is limited, the number of meets that can be scheduled may be important.
5. When there is a limited number of teams competing in an area, interest may be stimulated by a schedule that includes both a round-robin tournament of dual meets and a schedule of triple-dual meets.
6. During a league season, a coach may have to postpone a meet. If rescheduling becomes difficult, the coach may want to consider scheduling a double-dual meet.

SCORE: Relays 7-0
Ind. 5-3-1

DOUBLE DUAL and TRIPLE DUAL MEET SCORE SHEET

Events	TEAM A vs. B Team A Bethpage Lanes 1 & 4 Team B Troy Lanes 2 & 5 (team name)			TEAM A vs. C Team A Bethpage Lanes 1 & 4 Team C Plainview Lanes 3 & 6 (team name)			TEAM B vs. C Team B Troy Lanes 2 & 5 Team C Plainview Lanes 3 & 6 (team name)		
	Finish Scratch Lanes 3 & 6	Team A Lanes 1 & 4	Team B Lanes 2 & 5	Finish Scratch Lanes 2 & 5	Team A Lanes 1 & 4	Team C Lanes 3 & 6	Finish Scratch Lanes 1 & 4	Team B Lanes 2 & 5	Team C Lanes 3 & 6
#1 200 M.R.	3 4 1 5 2 6	1st 7 — 7	0 — 0	3 4 1 5 2 6	0 — 0	1st 7 — 7	3 4 1 5 2 6	0 — 0	1st 7 — 7
#2 200 Free	4 5 3 2 1 6	1st 5 — 12	2nd & 3rd 3-1 — 4	4 5 3 2 1 6	1st & 3rd 5-1 — 6	2nd 3 — 10	4 5 3 2 1 6	1st & 3rd 5-1 — 6	2nd 3 — 10
#3 100 Br.									
#4 100 Back									
#5 100 I.M.									
#6 50 Free									
#7 Diving	A A B C B C	1st & 2nd 5-3	3rd 1	A A B C B C	1st & 2nd 5-3	3rd 1	A A B C B C	1st & 3rd 5-1	2nd 3
#8 50 Butter									
#9 100 Free									
#10 50 Br.									
#11 50 Back									
#12 400 Fr. R.									

OFFICIAL TEAM ENTRY SHEET

Team A _____ Lanes 1 & 4

Team B _____ Lanes 2 & 5

Team C _____ Lanes 3 & 6

(Name of Team)

For use in:
Triangular Meets
Double Dual Meets
Triple Dual Meets

Date: _____

EVENT	A Lane 1	B Lane 2	C Lane 3	A Lane 4	B Lane 5	C Lane 6
#1 Medley Relay						
	Times:					
#2 200 Free						
	Times:					
#3 100 Breast						
	Times:					
#4 100 Back						
	Times:					
#5 100 I.M.						
	Times:					
#6 50 Free						
	Times:					
#7 Diving Order of F.	Team A		Team B		Team C	
#8 Butterfly						
	Times:					
#9 100 Free						
	Times:					
#10 50 Breast						
	Times:					
#11 50 Back						
	Times:					
#12 400 Free Relay						
	Times:					

L.B.

Procedure for a Triple-Dual Meet in a 6-Lane Pool

A. The scoring system governing the meet is that which applies to a dual meet in a 4-lane pool. Each team is allowed two entries per event. Diving order is by draw.

B. Prior to the start of the meet:

1. The referee meets with the three coaches and:
   a. Has coaches draw for the required dive.
   b. Has coaches draw for lanes and team code letter assignments.
   Example:

Team A___	Team B___	Team C___
Lanes 1 & 4	Lanes 2 & 5	Lanes 3 & 6

   c. Collects from each coach a team roster and give this to the chief recorder.
2. The Chief Recorder:
   a. Receives from the referee the cards with team code letters, lane assignments and team name; records this information on the team entry work sheet and meet score sheet. (See forms on pages and .)
   The team code letter is also recorded on the diving sheets.
   b. Sets up and coordinates the scoring table
      1) Clerk #1 receives team entry cards from the official and checks names on the team roster for legal entries. (Suggested procedure: Place *I* next to the name if entered in an individual event and an *R* if entered in a relay.)
      2) Clerk #2 records the names on the team entry work sheet and records the official times on the work sheet as they become available.
      3) Clerk #3 assists the chief recorder, where necessary, in posting scores, scoring diving sheets, etc.

C. During the meet:

1. The officials judge the finishes of each event "acosss-the-board" by lanes, and the referee sends the results to the chief recorder.
   Example: Order of finish - 4, 3, 6, 2, 1, 5.
2. The chief recorder lists the complete order of finish for the event for each of the dual meets on the scoresheet.
   a. The lanes not involved in the particular dual meet are then scratched and the places and scores for the dual meet teams are recorded.
   b. This procedure is repeated for each of the dual meets.
   c. The diving event order of finish is recorded on the score sheet by team code letter, that is, A, A, B, C, B, C. The code letter not applicable to the dual meet is scratched and places and points are awarded accordingly.
   (See sample score sheet for example of scoring procedure.)

Procedure for a Double-Dual Meet in a 6-Lane Pool

All procedures above apply to this meet with the following exception:
The dual meet scoring area not applicable to the meet is scratched on the triple-dual meet score sheet.
Example: A vs. B
A vs. C

Summary

The double-dual and triple-dual meet is a structure that, in many instances, has been overlooked. With a procedure for structuring and scoring such a meet, the coach

with imagination and initiative can expand the scheduling of competitive swimming. The officials can proceed, with confidence, in a meet that is well organized.

NAGWS OFFICIATING: SUGGESTED CHANGES FOR MORE FUNCTIONAL OPERATION

CONSTANCE BIRKIE
BONNIE EDWARDS

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Bonnie Edwards received her BA and Standard Secondary Credential from San Jose State University, San Jose, California. She teaches mathematics and physical education at Homestead High School and coaches the girls swimming team. She has been a NAGWS national swimming official for the last 11 years and has taught numerous classes and clinics on swimming officiating.

Currently, nationally rated NAGWS swimming officials are highly competent, knowledgeable individuals well qualified to handle meet situations as lead officials, i.e. referee. Unfortunately, officials of this caliber are too scarce to meet the demands in competitive swimming programs in many areas. For lack of adequate NAGWS leadership and officiating, numerous swim programs throughout the United States are either turning to other organized entities for assistance, officials and sometimes jurisdictional control, or are using untrained and unqualified personnel in critical officiating positions. Ex-swimmers, swimmer's families and friends, and swimming supporters form an interested and motivated group and a barely tapped resource for more complete participation in the swimming officiating scene. It is suggested that through more flexible handling of the NAGWS officiating rating system and responsible report feedback at the local board level a greater number of capable officials could be developed to contribute to the operation of top grade programs for girls and women.

Training Officials

Present NAGWS swimming officiating examinations require the trainee to be immediately developed to the exacting qualifications of a referee or the trainee remains unrated. Consequently, many potential officiating participants are quickly discouraged by the large amount of highly technical, varied information they are expected to digest rapidly. Consequently too few officials are "qualified" to work in any capacity at meets, thereby increasing the use of "unqualified" personnel at the practical level. Hence, a change is suggested which allows trainees to concentrate on one officiating area at a time.

A. Timers and Judges

Timers and judges could function adequately without passing a written examination. An apprentice period could be developed with voluntary sign-ups prior to beginning of a meet. These inexperienced timers or judges would be assigned to work with two qualified timers or one qualified judge. Before the first race, the experienced personnel would review with the apprentice the handling of the equipment and the

pertinent rules. The apprentice would then work with the experienced personnel, and at the end of the meet the referee would review the time cards or judging slips. A timer should be within ±0.2 second on the last 10 out of 12 races to become qualified. Judging slips of a new judge should agree with one or more experienced judges on 10 out of 12 races. A card that specifies specific officiating duties (see card sample #1) could then be issued by the referee with the section marked "lane timer" or "place judge" initialed and dated. Initialing and dating a section would indicate that the individual is qualified to perform that specific task. The referee would then send the names of any newly qualified personnel to the local board chairman.

OFFICIAL		
REFEREE		
Diving Referee	Starter	Chief Judge
Scorer	Chief Timer	Stroke & Turn Judge
Clerk of Course	Desk Recorders	Announcer
Lane Timer	Place Judge	Diving Judge

Figure 1. Card sample #1.

B. Diving Judges

A potential diving judge would attend a clinic or workshop on judging diving and practice judging 12 to 15 filmed dives, including broken position, knees spread, etc. A trainee should agree within ±1 point on 10 out of 12 dives with a panel of three or more qualified judges to receive an apprentice card. With the apprentice card, the trainee should work with two or more experienced judges for at least three meets and agree within ±1 point on at least 90 percent of the dives at the meet. The diving referee would then initial and date the officiating card for diving officiating. After three initialed, successful meet working experiences, the trainee's name would be sent to the officiating board as a qualified diving judge.

C. Stroke and Turn, Starter, Chief Judge, Scorer, Chief Timer, Desk Recorders

Trainees in these areas should attend a clinic or workshop held before a meet, practice the specific task with trained personnel during the meet and pass a simple written test on the specific area after the meet. Meeting these standards would result in the issuance of an apprentice card. Followup would encompass work at five or more meets with experienced officials at that specific position. Five initialed and dated, successful meet working experiences, would then fully qualify a trainee; the last referee would then forward the official's name to the local board chairman. After a trainee becomes qualified to work at one level, further apprentice experience working with an experienced official would qualify him or her for the next higher level.

D. Swimming Referee and Diving Referee

The swimming referee trainee should be qualified in all areas, and work at least one year within the swim meet mileu. The referee trainee should then referee two or more dual meets under the supervision of an experienced referee to be qualified as a dual meet referee and apprentice two or more group meets for group meet qualification. NAGWS written examination and standards, limited to swimming rules, should also be administered for the group meet referee qualification.

The diving referee trainee should have at least one year experience as a diving judge, apprentice referee diving at at least two dual meets with an experienced diving judge and pass a written examination limited to diving rules. Further group meet apprenticeship of two or more successful meet work experiences would qualify the individual as a group meet diving referee.

Record Keeping

At the end of each meet the referee would send in names of all upgraded officials to the NAGWS local board chairman. Prior to the swimming season the board chairman would publish new listings to all high schools, colleges and universities within the board's jurisdiction of current ratings of all listed officials. Thus the board would become an integral part of the control, information and feedback of the officiating activities within its area; swimming coaches and activity directors would have a current list of referees and officials qualified to fill specific positions in their area.

Evaluation and Rerating of Current Officials

The board chairman would issue new cards every year. Timers and judges would receive automatic rerating if they worked during the previous rating period. Other officials would be required to attend regular refresher meetings whenever new rulebooks or rule changes were issued, as well as working during the previous rating period, in order to be rerated.

The board chairman would also maintain an evaluation card file (see card sample #2) on all officials except timers and judges. If an official achieves an average of at least 3.5 on a scale of 0 to 5 on at least five meets during the previous rating period, that official would be reinstated. It would be the responsibility of the official to request an evaluation card. If an official does not work during a rating period, the official should attend a clinic or workshop before reinstatement. If more than one rating period is missed, the individual should begin the rating process anew. If evaluation cards indicate that an official is doing a poor job, the board chairman should have the authority to downgrade the official accordingly.

Name of Official _____ Date _____

Person Responding _____ Sport _____

Circle Your Title: Coach Examiner, National, State Official

Circle the response which you believe indicates the competence of the official. 1 is lowest, 5 is highest.

KNOWLEDGE:	1	2	3	4	5
ACCURACY/ THOROUGHNESS	1	2	3	4	5
COVERAGE OF ASSIGNED RESPONSIBILITIES:	1	2	3	4	5
APPEARANCE	1	2	3	4	5
TACT/CONTROL	1	2	3	4	5
OVERALL COMPETENCY	1	2	3	4	5
	poor		average		excellent

COMMENTS:

Figure 2. Card sample #2.

Summary

The suggested proposal could work effectively within active boards on a voluntary basis for a trial period without violating the current NAGWS officiating rating standards for the lead position of referee. It is hoped that boards might attempt to implement the proposal and communicate progress and impressions to the national organization in the ongoing process of upgrading swimming officiating for girls and women in competition.

SWIMMING — A MOVEMENT APPROACH FOR ELEMENTARY CHILDREN

DONNA THOMPSON

Donna Thompson earned the Ph.D. degree from the Ohio State University, Columbus. She has taught physical education to students from preschool through college age. As an associate professor of physical education at the University of Northern Iowa, Cedar Falls, she is a specialist in elementary physical education and stresses the movement approach.

Movement

Movement education is an approach to physical education which uses Laban's (7), analysis of movement, emphasizes the variety of ways the body parts are moved and introduces several methods which foster maximum involvement of children with movement. As a result of being involved with a movement approach, children should be able to understand, control and improve the many ways their bodies move. The aim is to help children be efficient and effective movers.

One of the predominant advantages of this approach is the independence which it can foster in children. They learn to create unique ways to move and can tailor responses to their own abilities. Since the norm for passing or failing a response to a suggestion is nonexistent or extremely broad, the pressure is off the students for feeling that they must give the correct response. Instead, they begin to enjoy creating different responses, become less self-conscious, and are better able to enjoy their own and other's unique abilities. In addition, a movement approach enhances self-identification and self-understanding. Further, they begin to appreciate how they are alike and different from other children and how to move most efficiently.

Movement Analysis

To cope with movement, it is helpful to have a framework to use in the analysis. The movement model 1 below has two essential categories — elements of movement as derived from Laban (5), and analyzed body factors — the ways the body moves, as stated by Allenbaugh (2).

MOVEMENT MODEL 1

MOVEMENT ELEMENTS

Space	*Time*	*Force*	*Flow*
Range — near, medium, far	Fast	Hard-Soft	Bound: interrupted
Level — high, medium, low	Medium	Strong-Weak	
Direction — up, down, forward backward, sideways diagonal	Slow	Heavy-Light	Free: smooth
		Tight-Loose	
Shape — round, twisted, etc.			
Pathways — straight, curved			

BODY FACTORS

Body Parts	Bases of Support	Body Leads	Body Relationships	Body Control

Methods

In the application of movement, the teacher can use various methods, among them, *free exploration* and *guided discovery*. Free exploration is a method which encour-

ages children to explore and create a variety of responses to one problem which the teacher has presented. The emphasis is on finding as many ways as possible to solve a problem in order to develop neurological pathways, movement patterns and different responses. This approach seems most effective with young children or those in the early stages of development of a pattern.

As children grow older, they are ready to combine patterns into sequences in order to form skills. They are ready to perform skills more efficiently so they can be effective doers of particular sport skills. At that point, guided discovery becomes an effective method. The children are at a higher cognitive level and are ready to draw conclusions about various ways of performing movement. Thus the teacher's challenge is to present a series of problems designed to take children through a movement from the least efficient to the most efficient way to perform a skill. If the movement problems are interspersed with a series of evaluative questions with which children are to respond, the results can be an exciting session in the process of discovery. An example of these two approaches as applied to swimming follows.

Swimming Skills

Only a few elementary texts deal with aquatics and their coverage of the subject varies considerably. (See references, page 82). The American Red Cross has lists of skills which children should be able to perform if they are to be categorized at certain levels. Vannier and her colleagues (8) have adapted these skills to the abilities of young children and noted criteria for deciding whether children have performed each skill successfully. Kirchner (4) described various swimming programs across the country. Moran and Kalakian's (6) coverage of aquatic activities is extensive and developmental. Fait (3) has published a helpful correction chart. Seidel and her colleagues (7) list some ways to utilize space, force, time, and flow factors as well as some mechanical analysis concepts. Each of the books has a slightly different emphasis.

One way to use the movement model is to categorize skills under the movement element or dimension which is emphasized. Model 2 lists that analysis based on the

MOVEMENT MODEL 2
ANALYSIS OF SKILLS IN FINGERLING TEST

SPACE

Range – near, medium, far
- Finning
- Sculling
- Crawl, 15 ft.
- Elementary back, 15 ft.

Level – high, medium low
- Bobbing 10 times + rhythm breathing
- Prone glide and recovery
- Back glide and recovery
- Sitting dive
- Kneeling dive
- Jump (shoulder deep) level off, swim

Direction
- Prone glide and recovery
- Back glide and recovery
- Crawl, 15 ft.
- Elementary back, 15 ft.
- Jump (shoulder deep) level off, swim

Shape
- Prone float and recovery
- Jump (shoulder deep) level off, swim

Pathway
- Crawl, 15 ft.
- Elementary back, 15 ft.

FORCE
Breathing holding 4 objects
Crawl, 15 ft.
Elementary back, 15 ft.
Sitting dive
Kneeling dive
Jump (shoulder deep) level off, swim

TIME: Fast, medium, slow
Bobbing 10 times = rhythmic breathing

FLOW: Bound or free
Prone float and recovery
Back float

BODY FACTORS

Body Parts
Crawl, 15 ft.
Finning

Bases of Support
Bobbing
Prone float
Back float

Body Leads
Bobbing
Finning
Crawl
Elementary back

Body Control
Bobbing
Jump Drive

Body Relationships
Crawl
Elementary back
Sitting dive

testing procedures of Vannier et al.(8) Some skills might be placed in more than one category, depending on the emphasis which the teacher wishes the children to experience. Skills from the Fingerling test are categorized.

If a teacher were to select a theme around which to organize a lesson, some of the skills which might be appropriate to emphasize or develop are noted in Model 2. For example, a theme of change of Level and Body Parts might be appropriate early in the experiences of children. The next section develops this theme more fully.

Two Approaches For Application

Exploration

For children in the early elementary school grades, some free exploration of a theme is profitable. Taking the theme, Change of Level and Body Parts, a teacher might have the children deal with non-locomotor, locomotor and manipulative activities. As children are able to work with one another, a section on working with partners might be added. The questions or problems posed to the children all revolve around the theme. For example, the section on non-locomotor activities might stimulate children to move by making the following suggestions: Can you put your hands on the water? Can you put your face on the water? Can you count to five while your face is under the water? Can you find three ways to put your face and hands on the water? How low can you put your hands in the water? Can you touch three body parts while your hands are under the water? Can you touch three other parts while your face in under the water? Can you touch your knees while your head is under the water? Can you touch your ankles while your head is under the water? How low can you get while you are touching your waist? How low can you get while touching your knees? Can you get your head as low as your knees? Can you get your feet as high as your waist or your head? Find three ways to get your seat on the bottom of the pool. Can you move from a high to a low to a high level in the water? How can you do that two other ways? Can you find two ways to move from a high to low to medium level and then land on your feet?

Guided Discovery

As mentioned above, an approach that is particularly effective with older elementary children is guided exploration. The conditions for application of this method are

different from free exploration. The content has changed. Instead of using a theme derived from the movement elements, the theme is based on a specific sport skill and the analysis proceeds in a slightly different manner. Rather than explore the many ways to move, the emphasis is to focus on the most efficient way to use specific movement elements and dimensions to perform a skill most effectively. Please note that the categories in the analysis below have changed from those in Model 1 and that only the most important elements for the performance of the specific skill are emphasized in Model 3.

MODEL 3

MOVEMENT ELEMENTS
Space — far range, high level, forward direction, rectangular shape, straight pathway
Time — medium
Force — strong
Flow — free

BODY FACTORS
Body Leads — hands

MECHANICAL PRINCIPLES: Leverage, force, resistance
PRINCIPLES OF HUMAN MOVEMENT: Objective focus
BODY FOCUS: Head, arms, legs

Using the analysis developed by Allenbaugh(1) in Model 3 and principles of proceeding from simple to complex, general to specific, open-ended to more specific responses, how can you design questions (with a guided discovery approach) to lead students to develop the forward crawl?

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ORGANIZATIONS AND AGENCIES RELATING TO AQUATICS

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Amateur Athletic Union of the United States (AAU), 3400 W. 86th St., Indianapolis, IN 46268. (317) 297-2900.

American Camping Association (ACA), Bradford Woods, Martinsville, IN 46151. (317) 342-8456.

American Divers and Coaches Association (ADCA), c/o WADESCO, P.O. Box 45361, 8622 Bellenca Ave., Los Angeles, CA 90045.

American National Red Cross (ARC), 17th & E Sts., N.W., Washington, DC 20006. (202) 737-8300.

American Public Health Association (APHA), 1015 18th St., N.W., Washington, DC 20036. (202) 417-5000.

American Swimming Coaches Association (ASCA), c/o International Swimming Hall of Fame, 1 Hall of Fame Dr., Ft. Lauderdale, FL 33316. (305) 524-6536.

American Water Polo Coaches Association (AWPCA), c/o Water Polo Scoreboard, 1780 Spruce St. #5, Berdley, CA 94709.

Athletic Institute Inc. (AI), 705 Merchandise Mart, Chicago, IL 60654. (312) 644-3020.

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National Association of Underwater Instructors (NAUI), 22809 Bartom Rd., Brand Terrace (Colton), CA 92324. (714) 783-1862.

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Agencies Publishing Rules

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National Association for Girls and Women in Sport
National Collegiate Athletic Association
National Jewish Welfare Board
Young Men's Christian Association

Springboard Diving:

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American Divers and Coaches Association
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National Association for Girls and Women in Sport
National Collegiate Athletic Association
National Federation of State High School Associations

Synchronized Swimming:

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Federation International Natation Amateur
The International Academy of Aquatic Art
National Association for Girls and Women in Sport

Water Polo:

Amateur Athletic Union of the United States
Federation International Natation Amateur
National Collegiate Athletic Association

Agencies Providing Certification

Lifesaving and Water Safety:

American National Red Cross
National Surf Life Saving Association of America
Young Men's Christian Association

Skin and Scuba Diving:

National Association of Skin Diving Schools
National Association of Underwater Instructors
National Scuba Training Council
Professional Association of Diving Instructors
Scuba School International
Underwater Society of America
Young Men's Christian Association
(Los Angeles County has its own certification system and only honors certification within its program.)

AQUATIC RESEARCH
1972 - 1976

CAROL COOPER
University of Northern Iowa

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